FCC 47 CFR PART 15 SUBPART C
INDUSTRY CANADA RSS-210 ISSUE 8

CERTIFICATION CLASS 2 PERMISIVE CHANGE TEST REPORT

FOR

900MHz FHSS RF ID Reader

MODEL NUMBER: RFC-6100XR with Antenna Assembly ITCS-A-212

FCC ID: WFQRFC-6100XR
IC: 10717A-RFC6100XR

REPORT NUMBER: 10185788C

ISSUE DATE: April 12, 2014

Prepared for
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Suite 220
Saint Louis, MO 63104

Prepared by
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NVLAP LAB CODE 100414-0

Revision History

Rev.	Issue Date	Revisions	Revised By
--	2014-04-11	Initial Issue	BM

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: **RF Controls LLC**
1400 South 3rd Street
Suite 220
Saint Louis, MO 63104

EUT DESCRIPTION: The EUT (Equipment Under Test) is a 900MHz FHSS RF ID Reader with 4x4High Gain Steerable Beam Antenna.

MODEL: RFC-6100XR with Antenna Assembly ITCS-A-212

SERIAL NUMBER: Prototype

DATE TESTED: February 10, 2014 – February 25, 2014

APPLICABLE STANDARDS	
STANDARD	**TEST RESULTS**
CFR 47 Part 15 Subpart C	Pass
INDUSTRY CANADA RSS-210 Issue 8 Annex 8	Pass
INDUSTRY CANADA RSS-GEN Issue 3	Pass

**In order to show compliance as a system this report must be used in combination with UL issued report under order number 10185788A.*

UL Verification Services Inc. tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by UL Verification Services Inc. based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

Note: The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by UL Verification Services Inc. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL Verification Services Inc. will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, any agency of the Federal Government, or any agency of any government.

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2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.10-2009, FCC CFR 47 Part 2, FCC CFR 47 Part 15, RSS-GEN Issue 3, and RSS-210 Issue 8, FCC publication DA 00-705.

3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 333 Pfingsten Road, Northbrook, IL, USA.

UL Verification Services Inc. is accredited by NVLAP, Laboratory Code 100414-0. The full scope of accreditation can be viewed at http://ts.nist.gov/standards/scopes/100414.htm.

4. CALIBRATION AND UNCERTAINTY

4.1. MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

4.2. SAMPLE CALCULATION

Where relevant, the following sample calculation is provided:

Field Strength (dBuV/m) = Measured Voltage (dBuV) + Antenna Factor (dB/m) + Cable Loss (dB) – Preamp Gain (dB)
36.5 dBuV + 18.7 dB/m + 0.6 dB – 26.9 dB = 28.9 dBuV/m

4.3. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

Test	Range	Equipment	Uncertainty k=2
Conducted Emissions	150k-30MHz	LISN	2.29dB
Radiated Emissions	30-200MHz	Bicon 10m Horz	4.27dB
Radiated Emissions	30-200MHz	Bicon 10m Vert	4.28dB
Radiated Emissions	200-1000MHz	LogP 10m Horz	3.33dB
Radiated Emissions	200-1000MHz	LogP 10m Vert	3.39dB
Radiated Emissions	1-6GHz	Horn	5.02dB
Radiated Emissions	6-18GHz	Horn	5.34dB
Radiated Emissions	18-26GHz	Horn	6.60dB
Radiated Emissions	26-40GHz	Horn	7.02dB

Uncertainty figures are valid to a confidence level of 95%.

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5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

The EUT (Equipment Under Test) is a 900MHz FHSS RF ID Reader with 4x4 High Gain Steerable Beam Antenna Assembly ITCS-A-212. This report is for both the AC powered version and PoE powered version.

The antenna uses a radio module is manufactured by RF Controls LLC, certified under
FCC ID: WFQRFC-6100XR / IC:10717A-RFC6100XR

5.2. MAXIMUM OUTPUT POWER

The transmitter has a maximum peak conducted output power for ITCS-A-212 configuration as follows:

Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
902-928	T6.25	28.04	636.50

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio is part of RF Controls Steerable Beam Antenna with declared gain of 7.4dBi.

5.4. SOFTWARE AND FIRMWARE

The firmware installed in the EUT during testing was RFRFCC000b031914, rev. 00b.
The EUT driver software installed in the host support equipment during testing was EthtoSerialConfig.application, rev. 1.0.0.42.
The test utility software used during testing was EthtoSerialConfig.application, rev. 1.0.0.42.

5.5. WORST-CASE CONFIGURATION AND MODE

EUT can operate in three different modulation modes described by manufacturer as T6.25 (largest bandwidth), T12.5 (medium bandwidth), and T25 (smallest bandwidth). Preliminary measurements showed that the output power does not change with the bandwidth change. The only measurements conducted with all three bandwidths were the bandwidth measurements and the band-edge measurements.

The EUT can powered by 120V/60Hz or 48VDC via PoE. Power source does not change any characteristics of the transceiver.

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5.6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	**Manufacturer**	**Model**	**Serial Number**	**FCC ID**
Laptopt Computer	Generic	-	-	-
PoE Adapter	Generic			

I/O CABLES

I/O Cable List						
Cable No	**Port**	**# of identical ports**	**Connector Type**	**Cable Type**	**Cable Length (m)**	**Remarks**
0	Enclosure	1	n/a	n/a	n/a	-
1	Ethernet	1	RF-45	Cat5 or Cat6	> 3m	Ethernet
2	AC Mains	1	AC	AC	< 3m	Standard AC Computer Cable

TEST SETUP

The EUT is a fully functional, steerable beam antenna that incorporates a 900MHz FHSS RF Transceiver.

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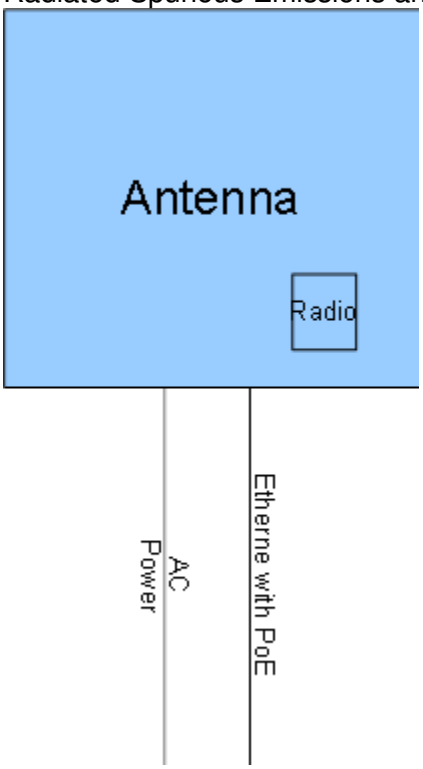
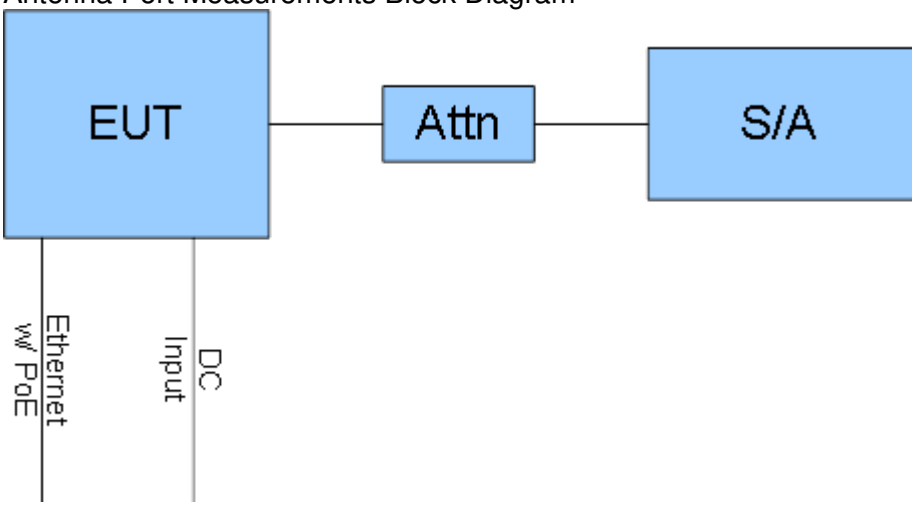
SETUP DIAGRAM FOR TESTS

Radiated Spurious Emissions and Line Conducted emissions



Antenna Port Measurements Block Diagram



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6. TEST AND MEASUREMENT EQUIPMENT

The following test and measurement equipment was utilized for the tests documented in this report:

Radiated Emissions – 10-Meter Chamber and Antenna Port

Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due Date
EMI Test Receiver	Rohde & Schwarz	ESU	EMC4323	20131227	20141231
Bicon Antenna	Chase	VBA6106A	EMC4078	20130213	20140228
Log-P Antenna	Chase	UPA6109	EMC4313	20131003	20141003
Spectrum Analyzer	Rhode & Schwarz	FSEK	EMC4182	20131226	20141231
Antenna Array	UL	BOMS	EMC4276	20130912	20140930
Spectrum Analyzer	Agilent	N9030A (PXA)	EMC4360	20131221	20141221
Attenuator	-	-	-	*-	*-
* Characterized at the time of testing.					

Conducted Emissions

Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due Date
EMI Test Receiver	Rohde & Schwarz	ESCI	EMC4328	Dec 30, 2013	Dec 30, 2014
Transient Limiter	Electro-Metrics	EM7600-2	EMC4224	N/A	N/A
HighPass Filter	Solar Electronics	2803-150	885551	N/A	N/A
Attenuator	HP	8494B	2831A00838	N/A	N/A
LISN - L1	Solar	8602-50-TS-50-N	EMC4052	Jan 15, 2014	Jan 16, 2015
LISN - L2	Solar	8602-50-TS-50-N	EMC4064	Jan 15, 2014	Jan 16, 2015

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7. ANTENNA PORT TEST RESULTS

7.1.1. OUTPUT POWER

LIMIT

§15.247 (b) (2)

RSS-210 Issue 7 Clause A8.4

The maximum antenna gain is 7.4dBi therefore the limit is 28.6dBm. While the radio is capable of maximum output power of 1 watt, the output is factory adjustable and may not be changed by installer. Output power was measured and specific setting for specific antenna assembly was established.

TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer the analyzer bandwidth is set to a value greater than the 20 dB bandwidth of the EUT.

RESULTS

Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	902.75	27.99	28.61	-0.62
Middle	914.75	28.04	28.61	-0.57
High	927.25	27.91	28.61	-0.70

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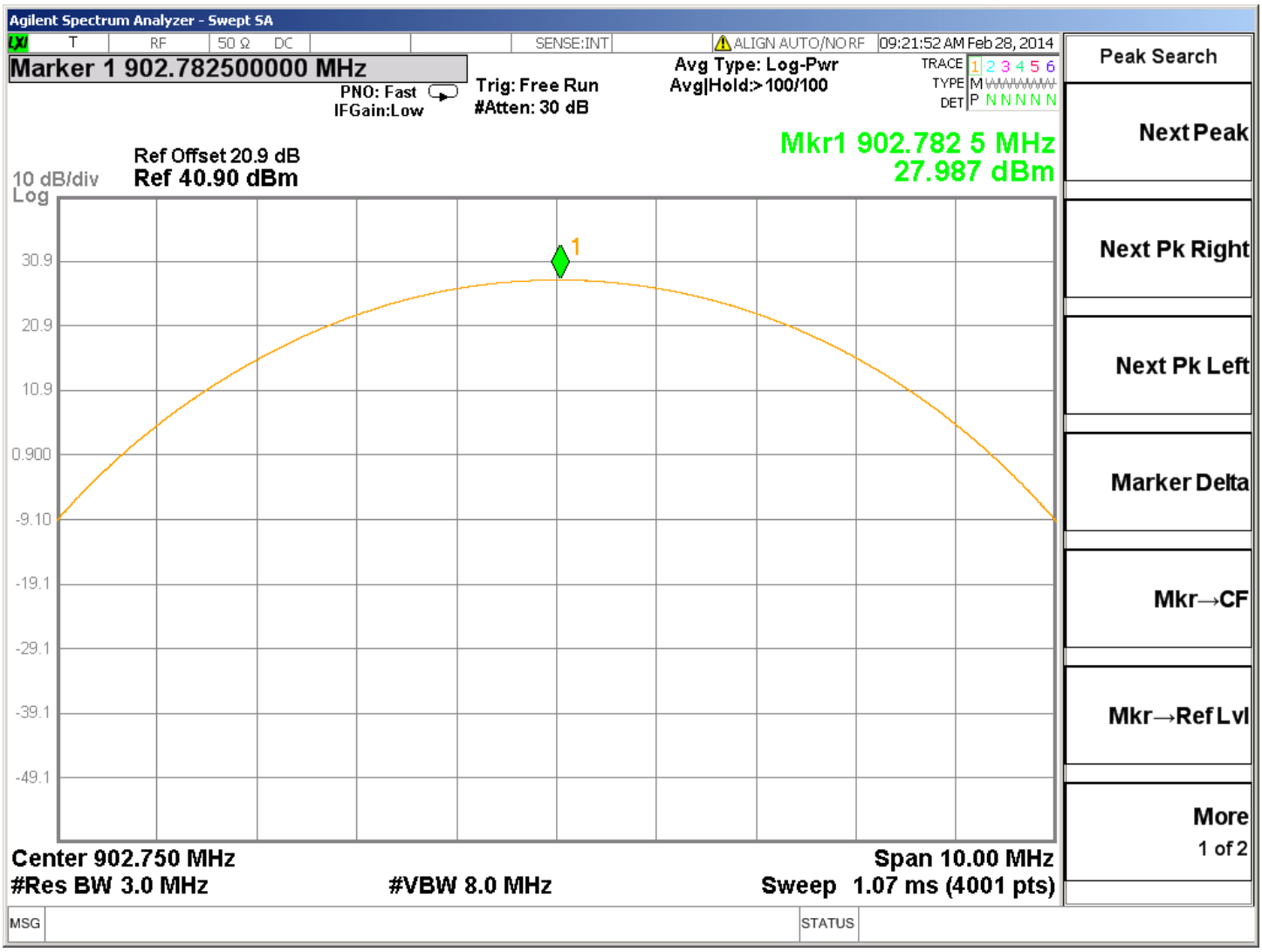
OUTPUT POWER

Low Channel



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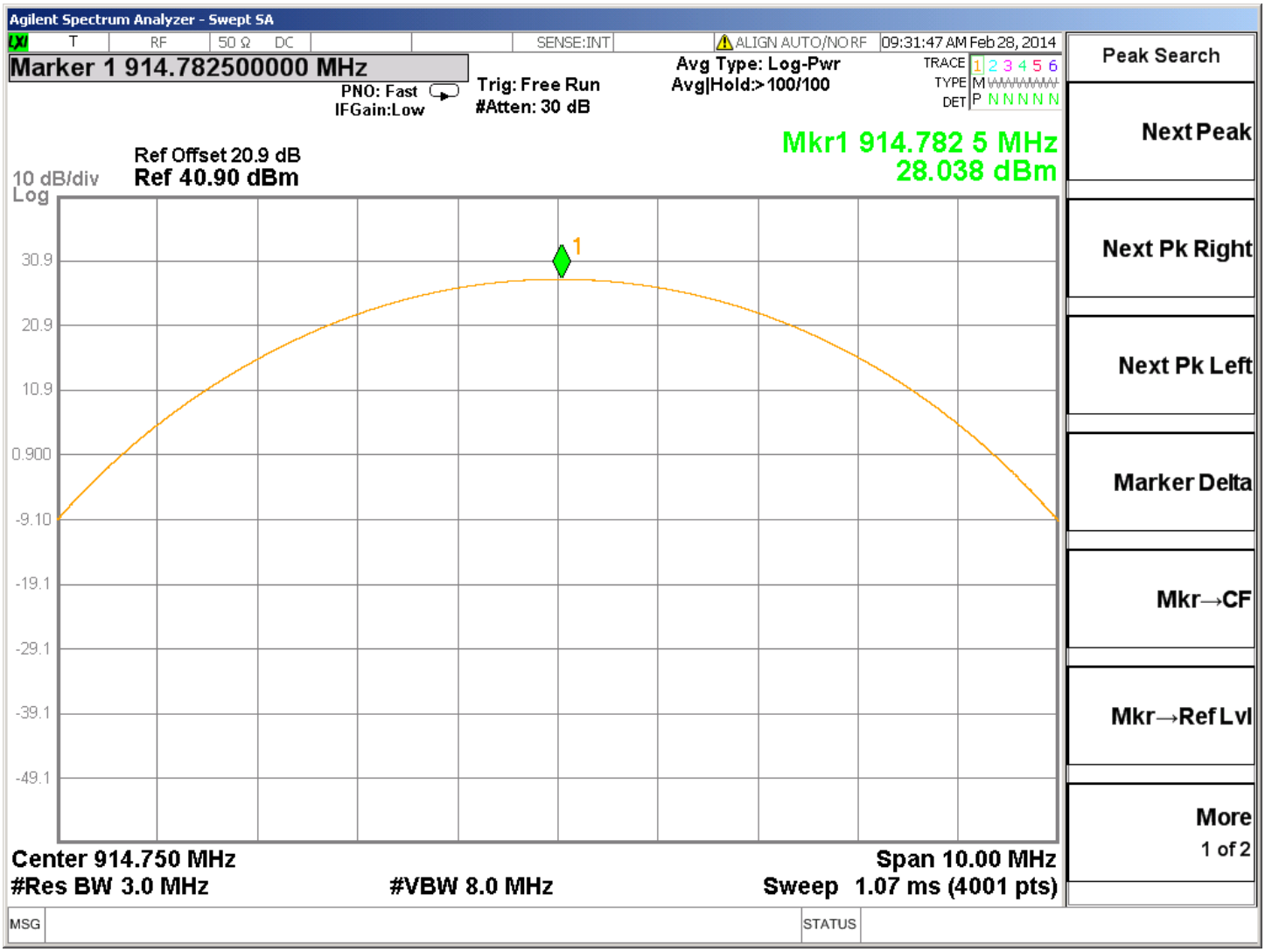
Middle Channel



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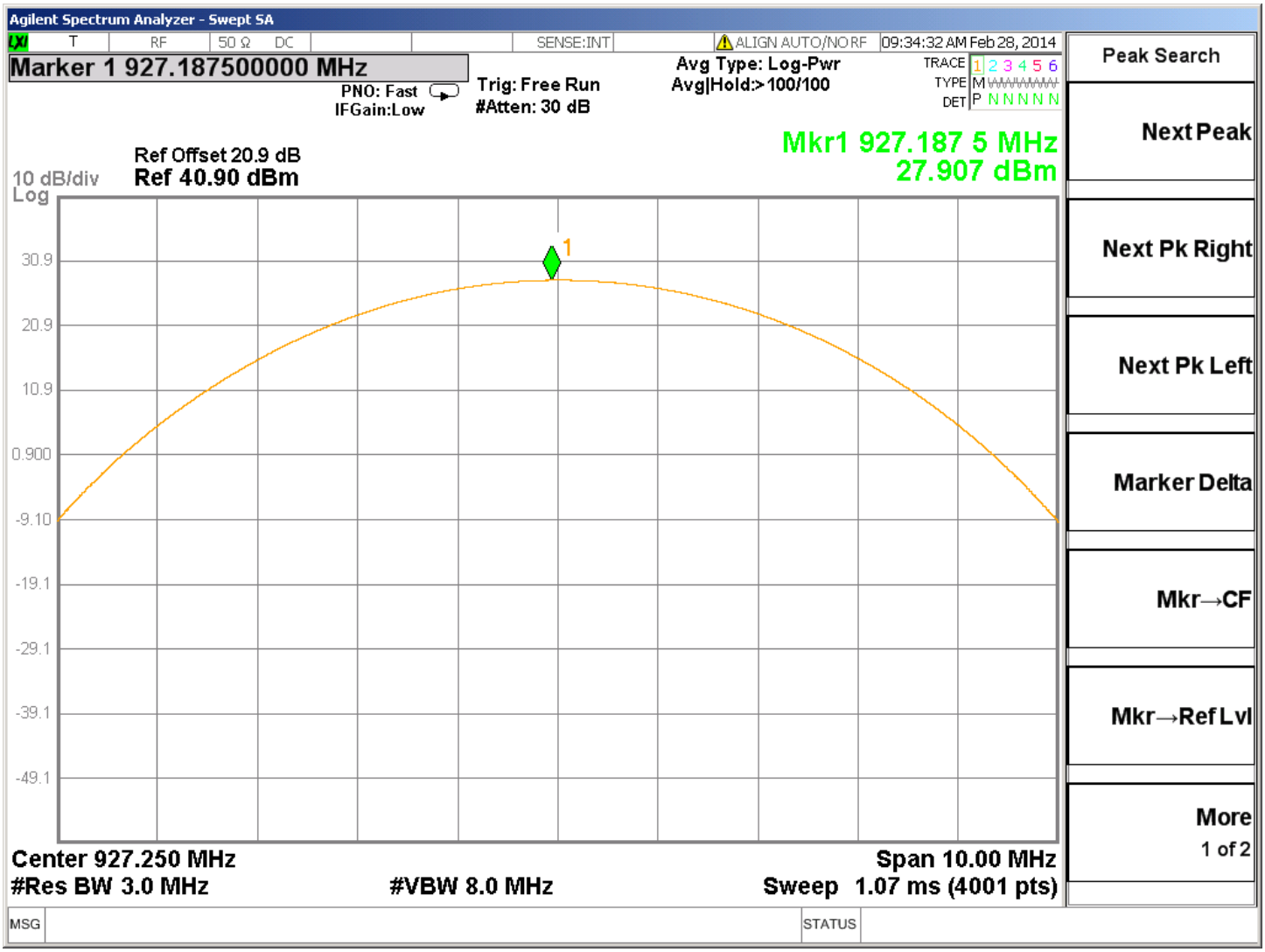
High Channel



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8. RADIATED TEST RESULTS

8.1. LIMITS AND PROCEDURE

LIMITS

FCC §15.205 and §15.209

IC RSS-210 Clause 2.6 (Transmitter)

Frequency Range (MHz)	Field Strength Limit (uV/m) at 3 m	Field Strength Limit (dBuV/m) at 3 m
30 - 88	100	40
88 - 216	150	43.5
216 - 960	200	46
Above 960	500	54

TEST PROCEDURE

The EUT is placed on a non-conducting table 80 cm above the ground plane. The antenna to EUT distance is 3 meters or 10 meters as noted. The EUT is configured in accordance with ANSI C63.4:2003. The EUT is set to transmit in a continuous mode.

For measurements below 1 GHz the resolution bandwidth is set to 100 kHz for peak detection measurements or 120 kHz for quasi-peak detection measurements. Peak detection is used unless otherwise noted as quasi-peak.

For measurements above 1 GHz the resolution bandwidth is set to 1 MHz, then the video bandwidth is set to 1 MHz for peak measurements and 10 Hz for average measurements.

The spectrum from 30 MHz to 10 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in the 900 MHz band.

The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized in both the vertical and the horizontal positions.

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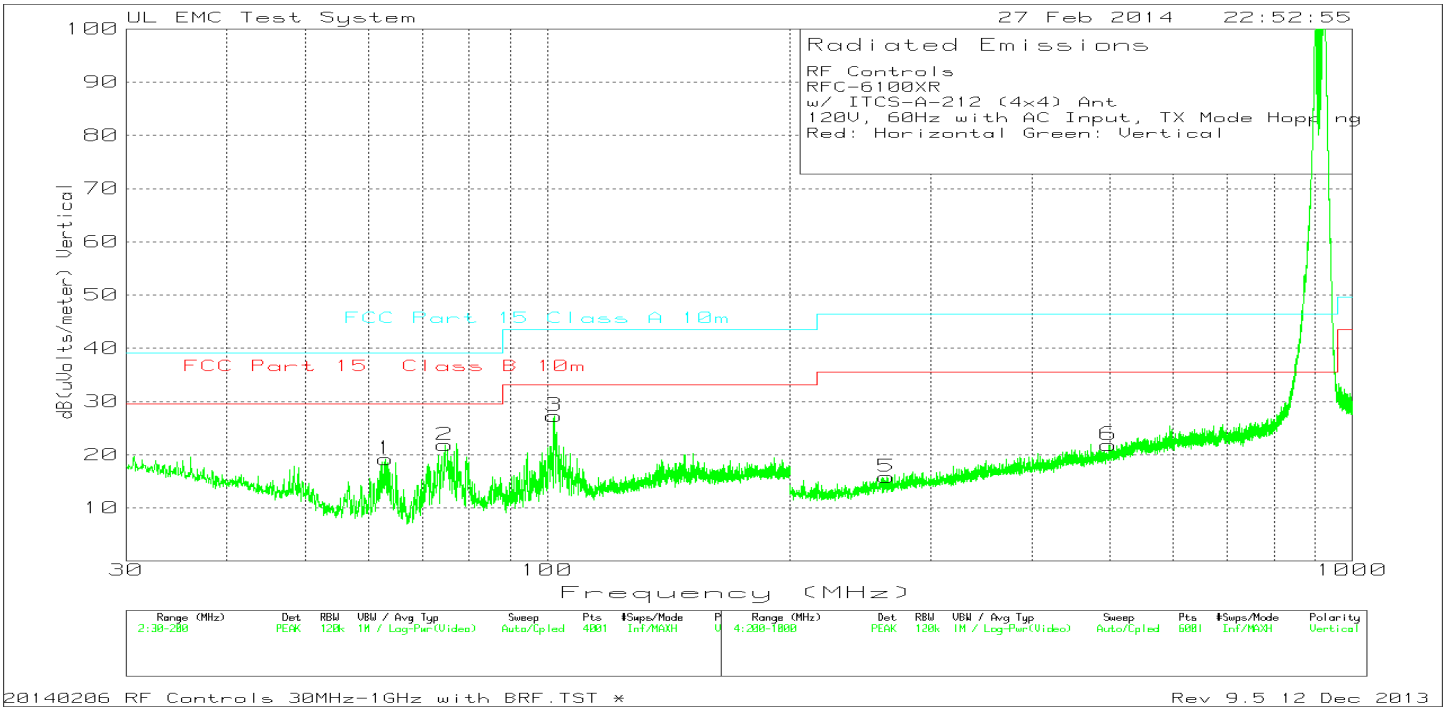
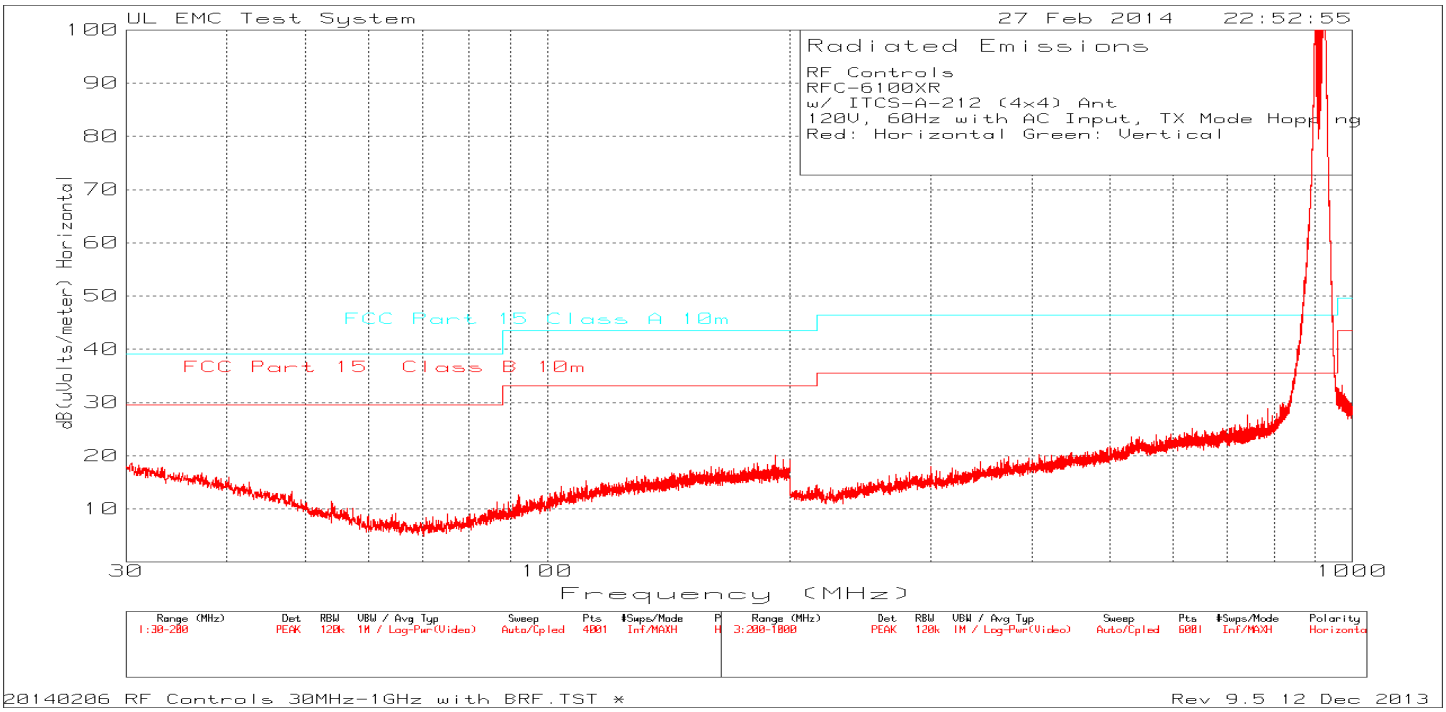
8.2. RADIATED SPUROUS BELOW 1 GHz

8.2.1. Radiated Spurious Emissions 30MHz-1GHz TX Hopping, AC Powered





* The area between 800MHz to1GHz above the limit is product of the HPF. There are no restricted bandedges covered by the HPF and there were no spurious emissions recorded any restricted bands below 1GHz. All emissions marked are product of digital part of the device. Measurement distance was set to 10 meters. Limits were extrapolated to 10 meter distance.

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RF Controls
RFC-6100XR
w/ ITCS-A-212 (4x4) Ant
120V, 60Hz with AC Input, TX Mode Hopping
Red: Horizontal Green: Vertical
Trace Markers

Marker No.	Test Frequency MHz	Meter Reading dBuV	Detector	Antenna Factor dB/m	Path Factor dB	BRF dB	Level dBuV/m	FCC Part 15.209 Limit dBuV/m	Margin dB	Azimuth [Degs]	Height [cm]	Polarity
1	63.0225	42.76	PK	6.4	-30	-	19.16	29.55	-10.39	0-360	249	V
2	74.5825	45.38	PK	6.4	-30	-	21.78	29.55	-7.77	0-360	400	V
3	101.91	46.22	PK	10.9	-29.8	-	27.32	33.07	-5.75	0-360	99	V
4	918.4	45.26	PK	23	-24.8	70.8	114.26	35.57	78.69	0-360	199	H
5	264.4	29.7	PK	12.4	-26.4	0.1	15.8	35.57	-19.77	0-360	399	V
6	499.3333	29.11	PK	17.6	-25.1	0.2	21.81	35.57	-13.76	0-360	399	V
7	924.8	45.15	PK	22.8	-24.6	83.8	127.15	-	-	0-360	99	V

Radiated Emission Data

	Test Frequency MHz	Meter Reading dBuV	Detector	Antenna Factor dB/m	Path Factor dB	BRF dB	Level dBuV/m	FCC Part 15.209 Limit dBuV/m	Margin dB	Azimuth [Degs]	Height [cm]	Polarity
	101.87239	45.77	QP	10.9	-29.8	-	26.87	33.07	-6.2	15	116	V

PK - Peak detector
QP - Quasi-Peak detector

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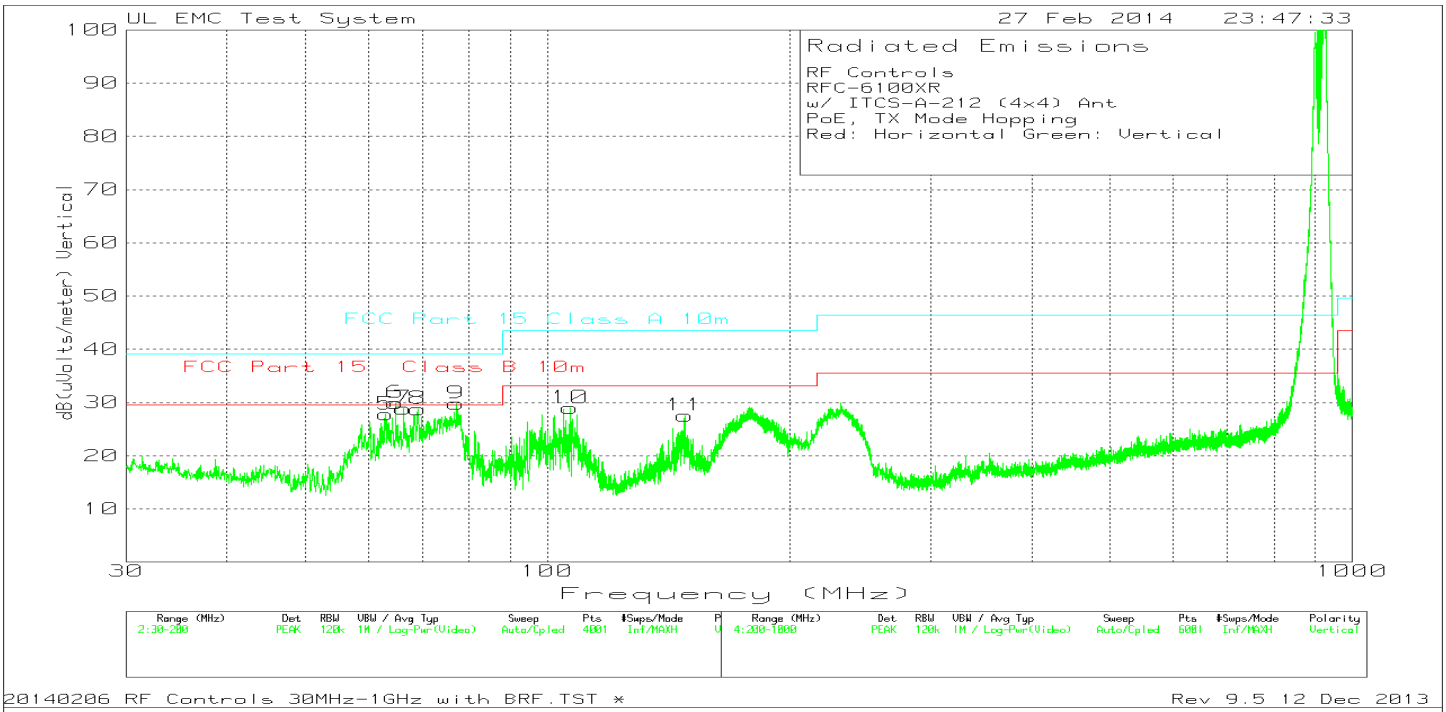
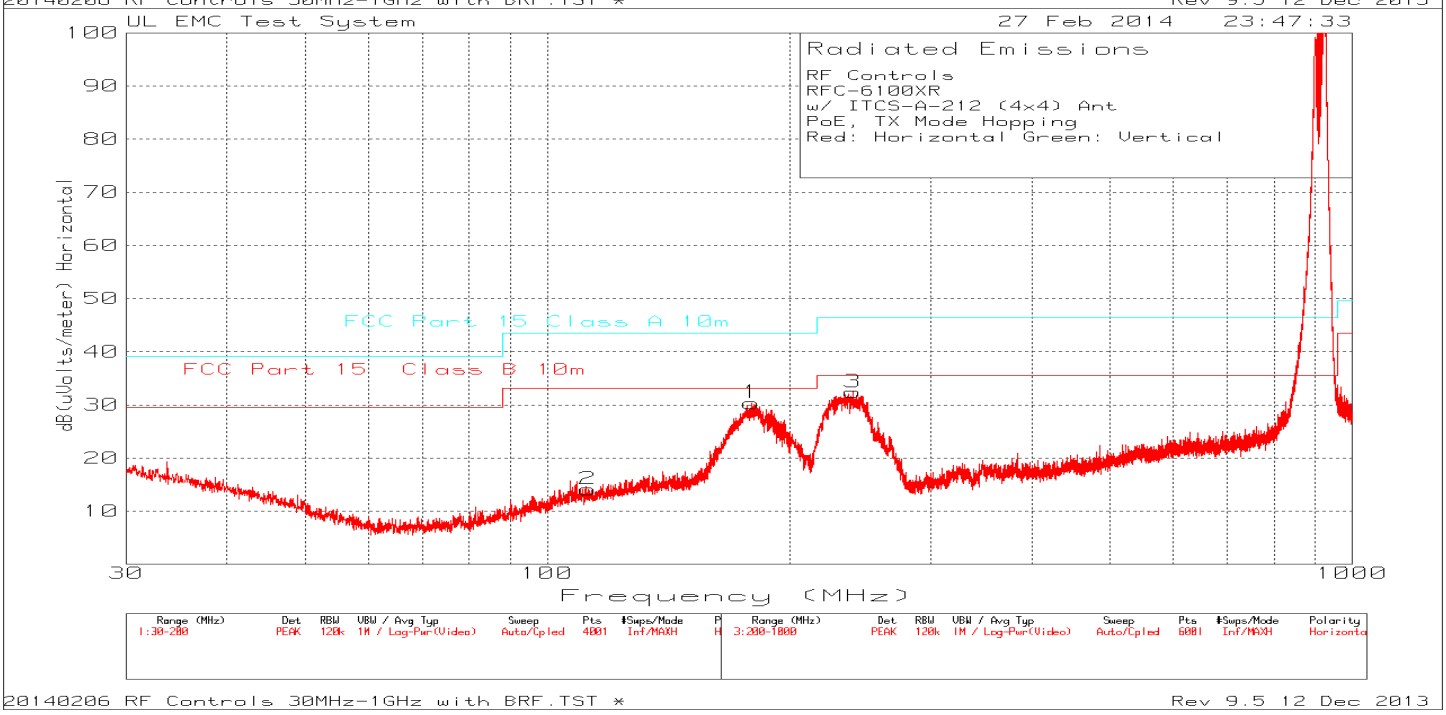
8.2.1. Radiated Spurious Emissions 30MHz-1GHz TX Hopping, PoE Powered





* The area between 800MHz to1GHz above the limit is product of the HPF. There are no restricted bandedges covered by the HPF and there were no spurious emissions recorded any restricted bands below 1GHz. All emissions marked are product of digital part of the device. Measurement distance was set to 10 meters. Limits were extrapolated to 10 meter distance.

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RF Controls
RFC-6100XR
w/ ITCS-A-212 (4x4) Ant
PoE, TX Mode Hopping
Red: Horizontal Green: Vertical
Trace Markers

Marker No.	Test Frequency MHz	Meter Reading dBuV	Detector	Antenna Factor dB/m	Path Factor dB	BRF dB	Level dBuV/m	FCC Part 15.209 Limit dBuV/m	Margin dB	Azimuth [Degs]	Height [cm]	Polarity
1	179.685	43.91	PK	15.7	-29.3	-	30.31	33.07	-2.76	0-360	400	H
2	112.3225	31.38	PK	12.5	-29.8	-	14.08	33.07	-18.99	0-360	400	H
5	63.0225	51.35	PK	6.4	-30	-	27.75	29.55	-1.8	0-360	249	V
6	64.765	53.69	PK	6.2	-30	-	29.89	29.55	0.34	0-360	249	V
7	66.295	52.67	PK	6.2	-30	-	28.87	29.55	-0.68	0-360	249	V
8	69.1425	52.66	PK	6.1	-30	-	28.76	29.55	-0.79	0-360	249	V
9	77.175	53.05	PK	6.6	-29.9	-	29.75	29.55	0.2	0-360	400	V
10	106.7125	47.15	PK	11.6	-29.8	-	28.95	33.07	-4.12	0-360	99	V
11	148.15	42.49	PK	14.6	-29.6	-	27.49	33.07	-5.58	0-360	99	V
3	239.6	47.6	PK	11.3	-26.6	0.1	32.4	35.57	-3.17	0-360	199	H
4	921.3333	43.83	PK	22.9	-24.9	81.2	123.03	-	-	0-360	199	H
12	907.3333	61.01	PK	23.2	-24.8	55.2	114.61	-	-	0-360	99	V

Radiated Emission Data

	Test Frequency MHz	Meter Reading dBuV	Detector	Antenna Factor dB/m	Path Factor dB	BRF dB	Level dBuV/m	FCC Part 15.209 Limit dBuV/m	Margin dB	Azimuth [Degs]	Height [cm]	Polarity
	179.6755	43.76	QP	15.7	-29.3	-	30.16	33.07	-2.91	318	356	H
	63.0001	46.26	QP	6.4	-30	-	22.66	29.55	-6.89	178	232	V
	64.7818	52	QP	6.2	-30	-	28.2	29.55	-1.35	245	248	V
	66.2998	49.83	QP	6.2	-30	-	26.03	29.55	-3.52	158	227	V
	69.1148	48.12	QP	6.1	-30	-	24.22	29.55	-5.33	245	199	V
	77.200787	50.06	QP	6.6	-29.9	-	26.76	29.55	-2.79	186	386	V
	106.695	45.72	QP	11.6	-29.8	-	27.52	33.07	-5.55	159	120	V
	148.1206	39.47	QP	14.6	-29.6	-	24.47	33.07	-8.6	233	105	V
	239.615	42.59	QP	11.3	-26.6	0.1	27.39	35.57	-8.18	319	254	H

PK - Peak detector
QP - Quasi-Peak detector

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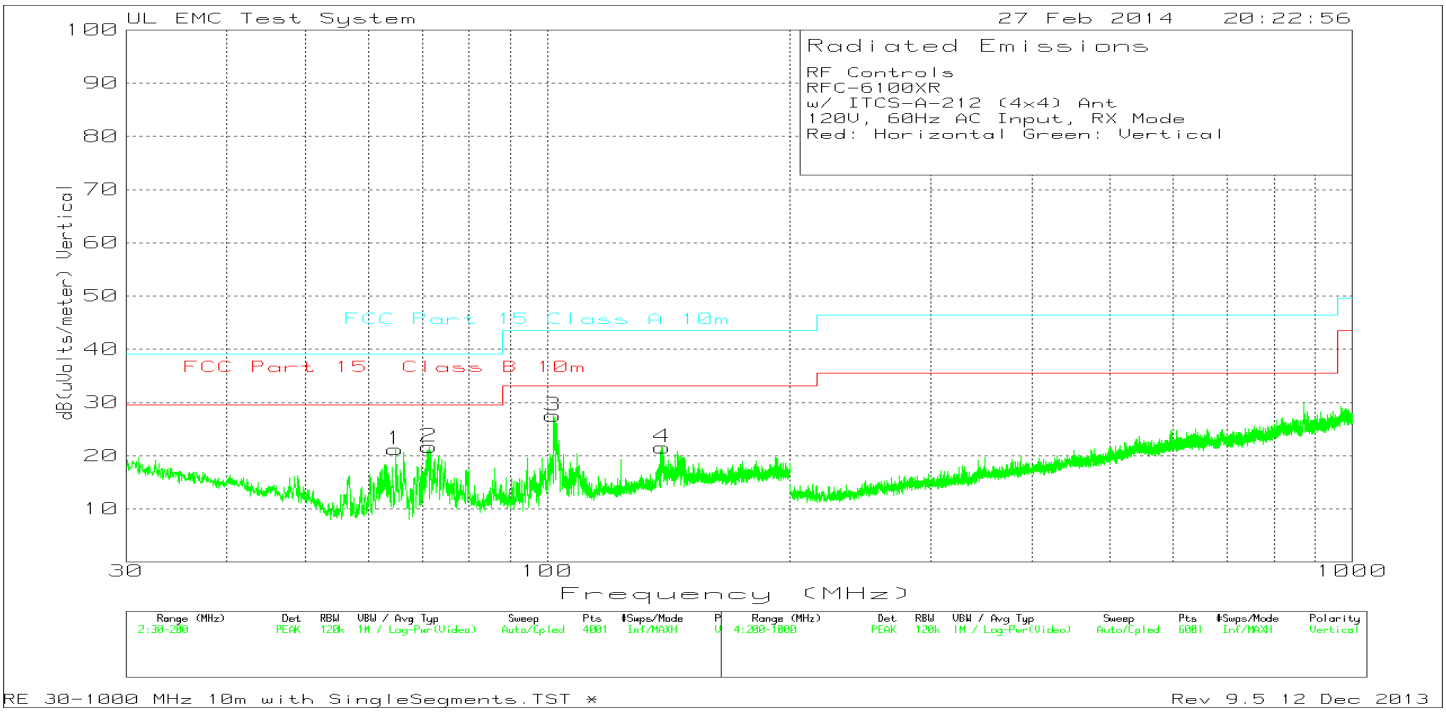
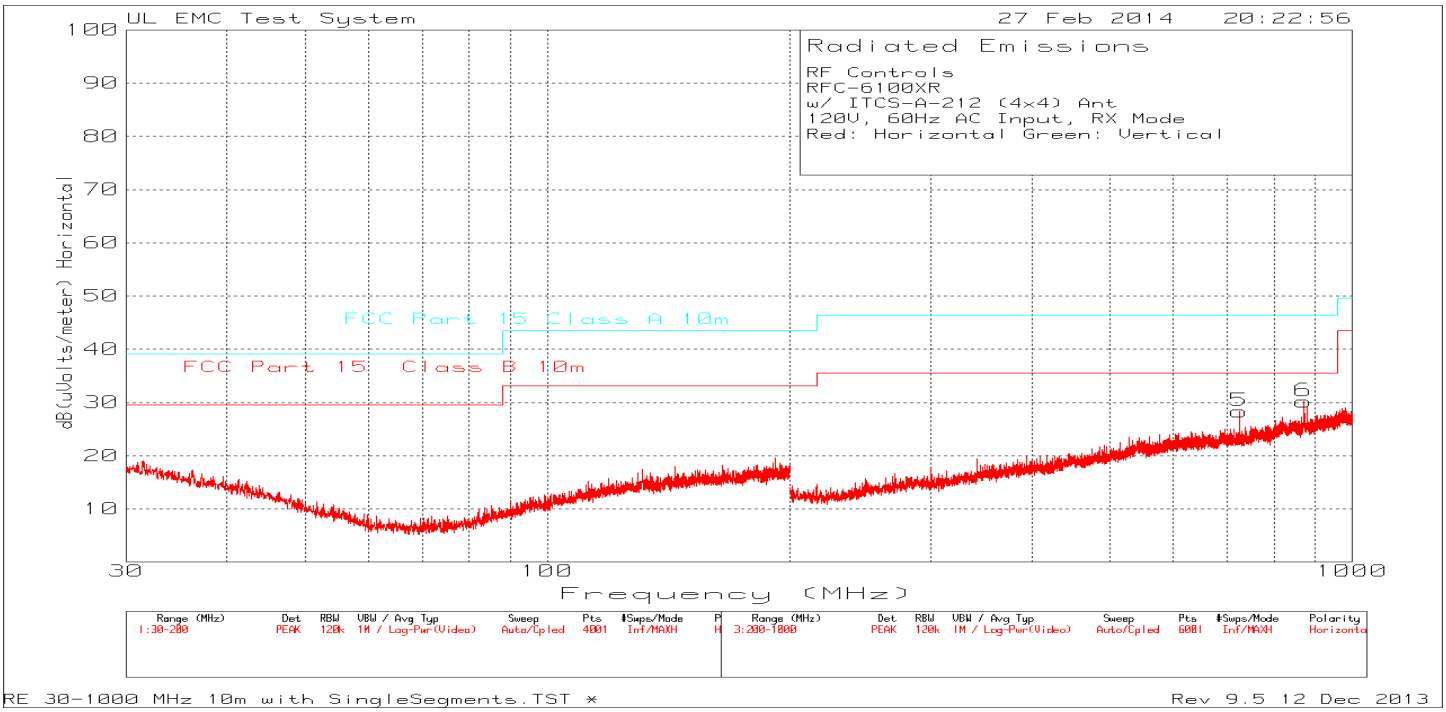
8.2.2. Radiated Spurious Emissions 30MHz-1GHz RX/ Digital Hopping AC Powered





* Measurement distance was set to 10 meters. Limits were extrapolated to 10 meter distance.

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RF Controls
RFC-6100XR
w/ ITCS-A-212 (4x4) Ant
120V, 60Hz AC Input, RX Mode
Red: Horizontal Green: Vertical
Trace Markers

Marker No.	Test Frequency MHz	Meter Reading dBuV	Detector	Antenna Factor dB/m	Path Factor dB	Level dBuV/m	FCC Part 15 Class B 10m	Margin (dB)	Azimuth [Degs]	Height [cm]	Polarity
1	64.765	45.03	PK	6.2	-30	21.23	29.55	-8.32	0-360	400	V
2	71.4375	45.5	PK	6.1	-29.9	21.7	29.55	-7.85	0-360	250	V
3	101.8675	46.41	PK	10.9	-29.8	27.51	33.07	-5.56	0-360	99	V
4	139.2675	36.97	PK	14.3	-29.7	21.57	33.07	-11.5	0-360	99	V
5	725.0667	32.34	PK	20.4	-24.4	28.34	35.57	-7.23	0-360	100	H
6	871.0667	32.22	PK	22.5	-24.5	30.22	35.57	-5.35	0-360	299	H

Radiated Emission Data

	Test Frequency MHz	Meter Reading dBuV	Detector	Antenna Factor dB/m	Path Factor dB	Level dBuV/m	FCC Part 15 Class B 10m	Margin (dB)	Azimuth [Degs]	Height [cm]	Polarity
	101.87057	43.91	QP	10.9	-29.8	25.01	33.07	-8.06	77	120	V

PK - Peak detector
QP - Quasi-Peak detector

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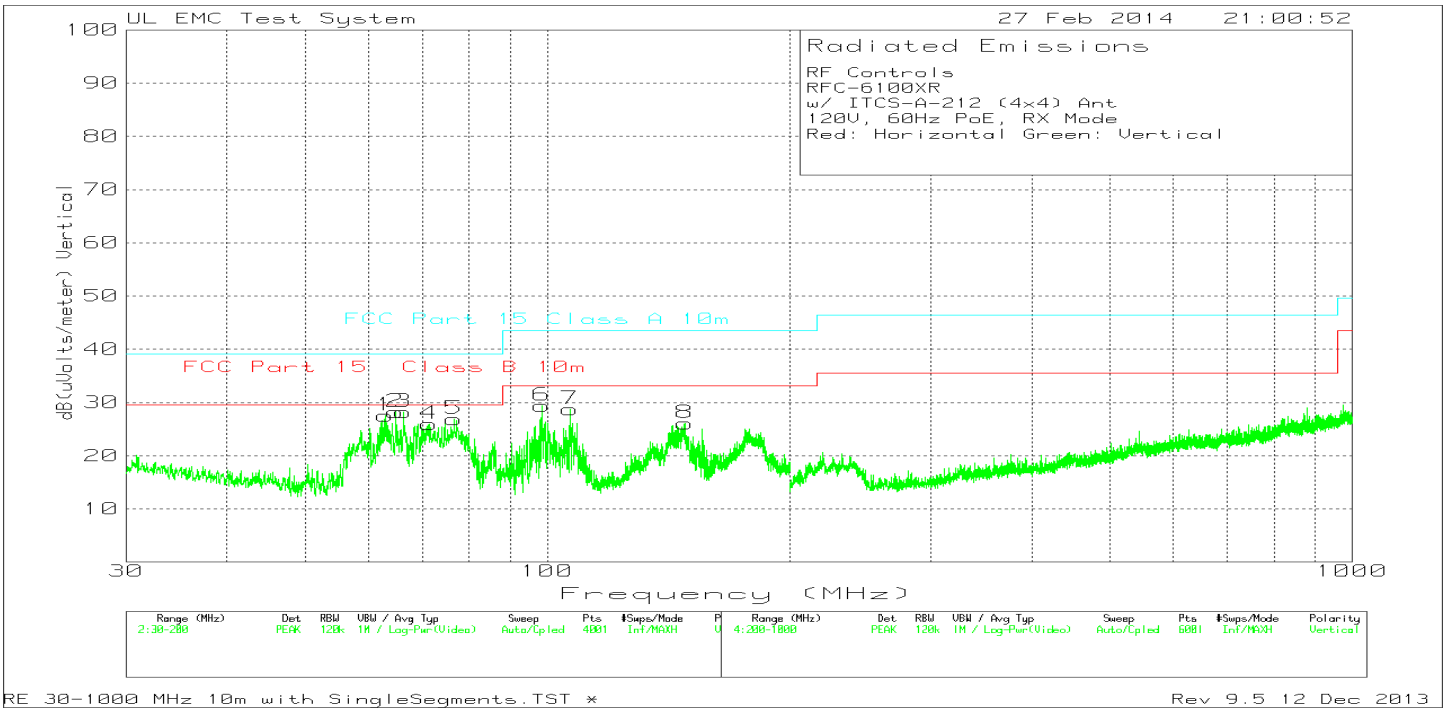
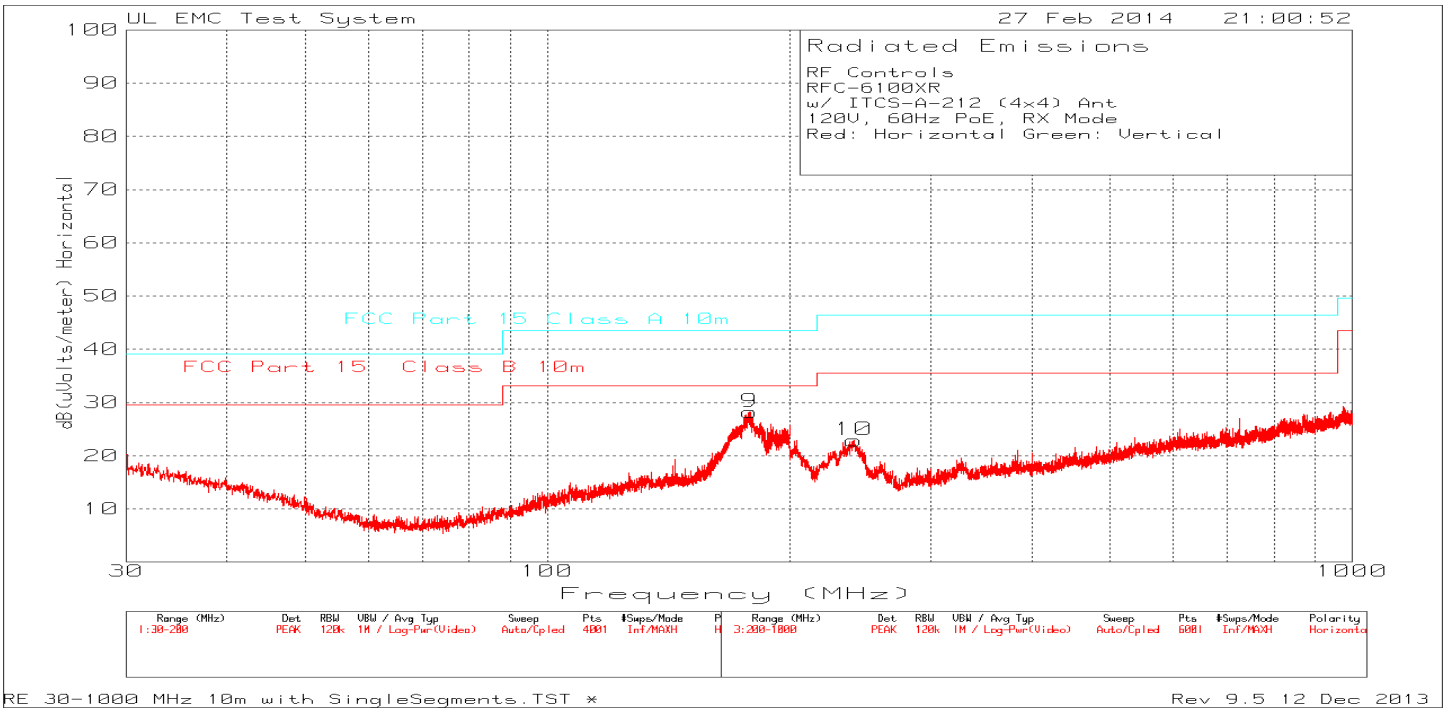
8.2.3. Radiated Spurious Emissions 30MHz-1GHz RX/ Digital Hopping PoE Powered





* Measurement distance was set to 10 meters. Limits were extrapolated to 10 meter distance.

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RF Controls
RFC-6100XR
w/ ITCS-A-212 (4x4) Ant
120V, 60Hz PoE, RX Mode
Red: Horizontal Green: Vertical
Trace Markers

Marker No.	Test Frequency MHz	Meter Reading dBuV	Detector	Antenna Factor dB/m	Path Factor dB	Level dBuV/m	FCC Part 15 Class B 10m	Margin (dB)	Azimuth [Degs]	Height [cm]	Polarity
9	178.58	41.97	PK	15.6	-29.3	28.27	33.07	-4.8	0-360	400	H
1	62.98	51.11	PK	6.4	-30	27.51	29.55	-2.04	0-360	249	V
2	64.765	52.01	PK	6.2	-30	28.21	29.55	-1.34	0-360	249	V
3	66.295	51.98	PK	6.2	-30	28.18	29.55	-1.37	0-360	249	V
4	71.395	49.78	PK	6.1	-29.9	25.98	29.55	-3.57	0-360	249	V
5	76.5375	50.23	PK	6.6	-29.9	26.93	29.55	-2.62	0-360	400	V
6	98.4675	48.92	PK	10.4	-29.9	29.42	33.07	-3.65	0-360	99	V
7	106.755	46.84	PK	11.7	-29.8	28.74	33.07	-4.33	0-360	99	V
8	148.15	41.14	PK	14.6	-29.6	26.14	33.07	-6.93	0-360	99	V
10	240.6667	38.08	PK	11.4	-26.6	22.88	35.57	-12.69	0-360	399	H

Radiated Emission Data

	Test Frequency MHz	Meter Reading dBuV	Detector	Antenna Factor dB/m	Path Factor dB	Level dBuV/m	FCC Part 15 Class B 10m	Margin (dB)	Azimuth [Degs]	Height [cm]	Polarity
	178.485	40.66	QP	15.6	-29.3	26.96	33.07	-6.11	323	350	H
	62.9917	46.52	QP	6.4	-30	22.92	39.08	-6.63	317	232	V
	64.7832	51.73	QP	6.2	-30	27.93	39.08	-1.62	323	244	V
	66.270287	49.79	QP	6.2	-30	25.99	39.08	-3.56	333	222	V
	71.4282	46.12	QP	6.1	-29.9	22.32	39.08	-7.23	343	223	V
	76.5586	45.55	QP	6.6	-29.9	22.25	39.08	-7.3	358	400	V
	98.45359	47.11	QP	10.4	-29.9	27.61	43.52	-5.46	347	121	V
	106.6982	44.73	QP	11.6	-29.8	26.53	43.52	-6.54	51	111	V

PK - Peak detector
QP - Quasi-Peak detector

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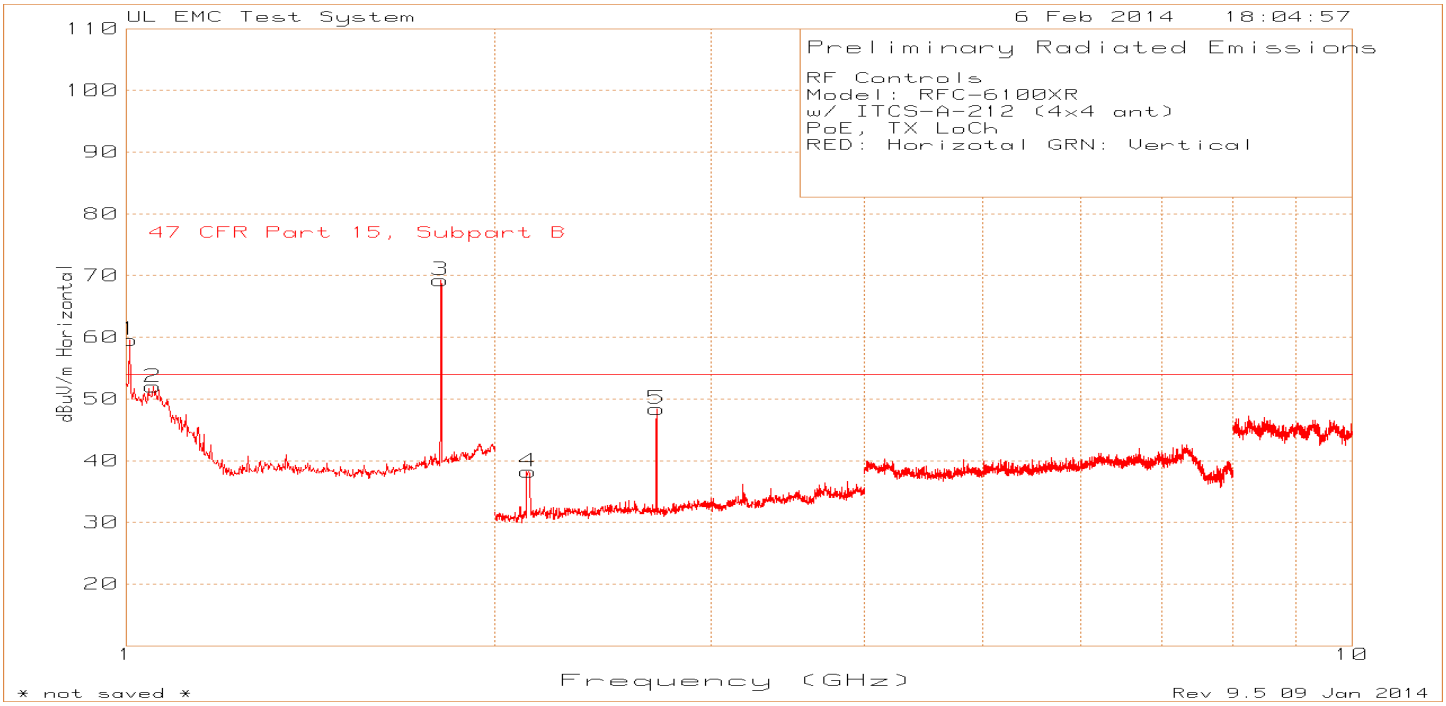
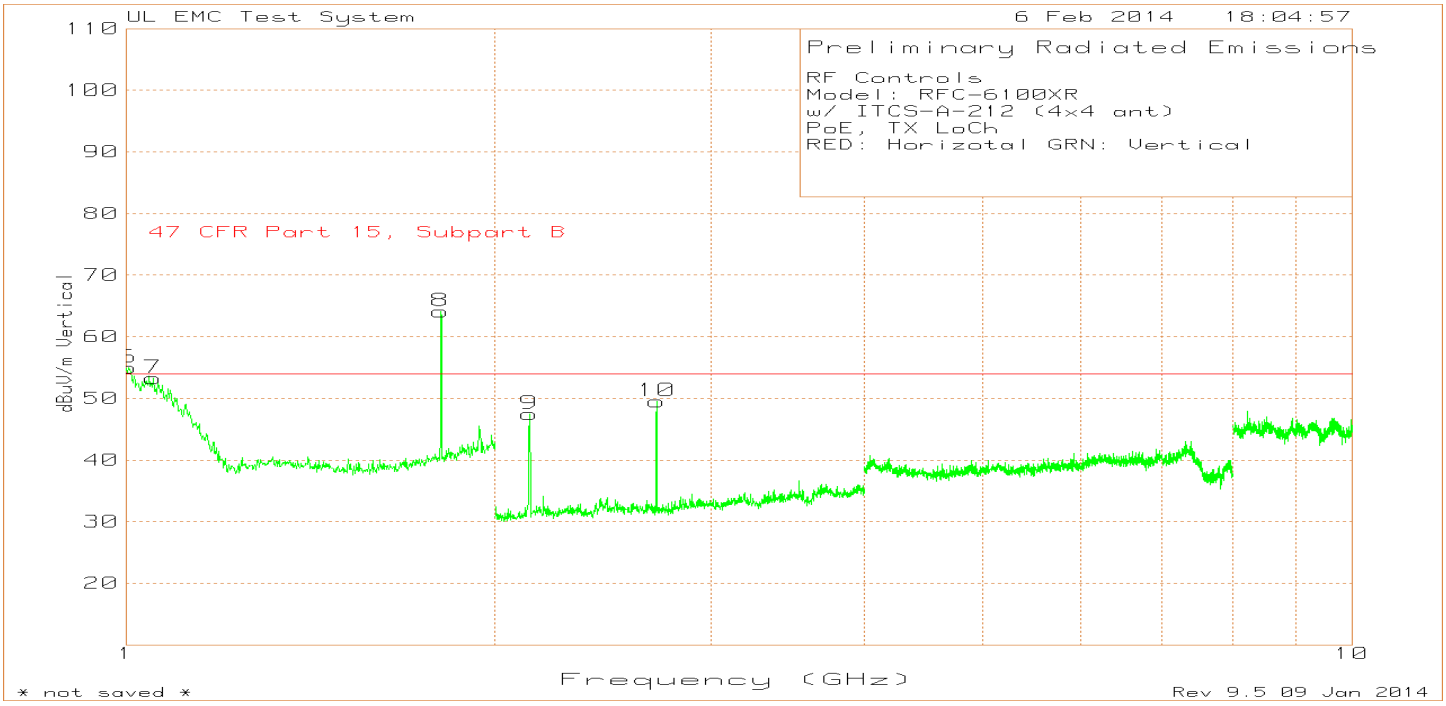
8.3. TRANSMITTER ABOVE 1 GHz

8.3.1. Radiated Emissions 1GHz – 10GHz Low Channel, Bore Side Beam Setting





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RF Controls
Model: RFC-6100XR
w/ ITCS-A-212 (4x4 ant)
PoE, TX LoCh
RED: Horizotal GRN: Vertical
Trace Markers

Marker No.	Test Frequency GHz	Meter Reading dBuV	Detector	Antenna Factor dB/m	BRF Factor dB	Path Factor dB	Level dBuV/m	Limit FCC 15.209 dBuV/m	Margin (dB)	Azimuth [Degs]	Height [cm]	Polarity
1	* 1.006	87.05	PK	27.4	1	-55.87	59.58	54	5.58	0-360	106	H
2	* 1.0521	80.11	PK	27.3	0.6	-56.02	51.99	54	-2.01	0-360	149	H
3	**1.8056	92.47	PK	29.9	0.4	-53.52	69.25	-	-	0-360	149	H
4	2.1301	68.86	PK	21.5	-	-52.13	38.23	54	-15.77	0-360	149	H
5	* 2.7087	77	PK	22.1	-	-50.69	48.41	54	-5.59	0-360	100	H
6	* 1.004	82.41	PK	27.4	1.1	-55.86	55.05	54	1.05	0-360	100	V
7	* 1.0521	81.43	PK	27.3	0.6	-56.02	53.31	54	-0.69	0-360	100	V
8	**1.8056	87.32	PK	29.9	0.4	-53.52	64.1	-	-	0-360	199	V
9	2.1341	78.04	PK	21.5	-	-52.06	47.48	54	-6.52	0-360	149	V
10	* 2.7087	78.16	PK	22.1	-	-50.69	49.57	54	-4.43	0-360	149	V

Radiated Emission Data

	Test Frequency GHz	Meter Reading dBuV	Detector	Antenna Factor dB/m	BRF Factor dB	Path Factor dB	Level dBuV/m	Limit FCC 15.209 dBuV/m	Margin (dB)	Azimuth [Degs]	Height [cm]	Polarity
	* 1.0607	83.31	PK	27.2	0.5	-56.01	55	74	-19	360	144	H
	* 1.06	70.2	LnAv	27.2	0.5	-56.01	41.89	54	-12.11	360	144	H
	* 1.0515	83.55	PK	27.3	0.6	-56.03	55.42	74	-18.58	0	118	H
	* 1.0514	70.94	LnAv	27.3	0.6	-56.03	42.81	54	-11.19	0	118	H
	* 1.0039	85.69	PK	27.4	1.1	-55.86	58.33	74	-15.67	360	114	V
	* 1.004	72.92	LnAv	27.4	1.1	-55.86	45.56	54	-8.44	360	114	V
	* 1.0524	83.98	PK	27.3	0.6	-56.02	55.86	74	-18.14	360	109	V
	* 1.0517	71.51	LnAv	27.3	0.6	-56.03	43.38	54	-10.62	360	109	V
	* 2.7081	78.98	PK	22.1	-	-50.69	50.39	74	-23.61	355	106	H
	* 2.7081	76.21	LnAv	22.1	-	-50.69	47.62	54	-6.38	355	106	H
	* 2.7081	79.73	PK	22.1	-	-50.69	51.14	74	-22.86	355	144	V
	* 2.7081	76.98	LnAv	22.1	-	-50.69	48.39	54	-5.61	355	144	V

PK - Peak detector
LnAv - Linear Average detector
* Frequencies in restricted bands. General 15.209 limit applies.
** Second Harmonic, Not in Restricted Band, no applicable radiated limits.

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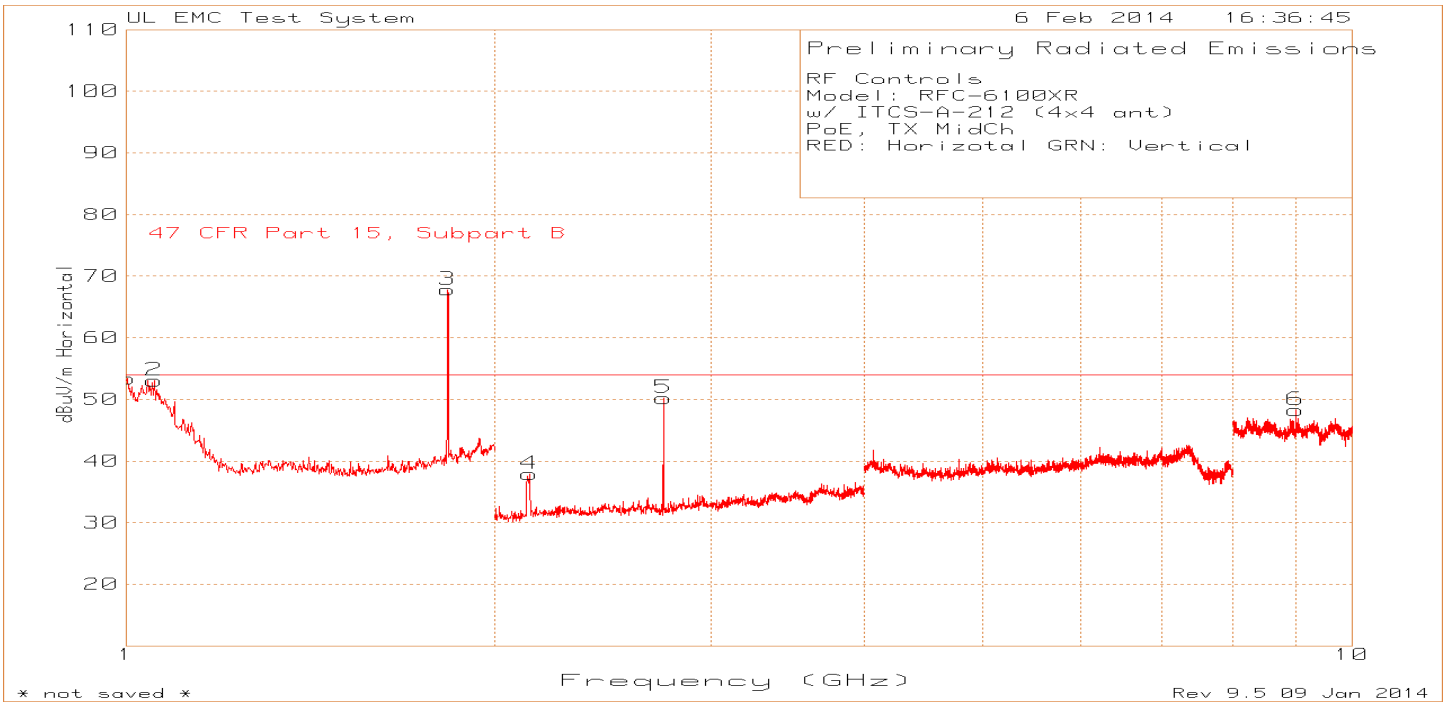
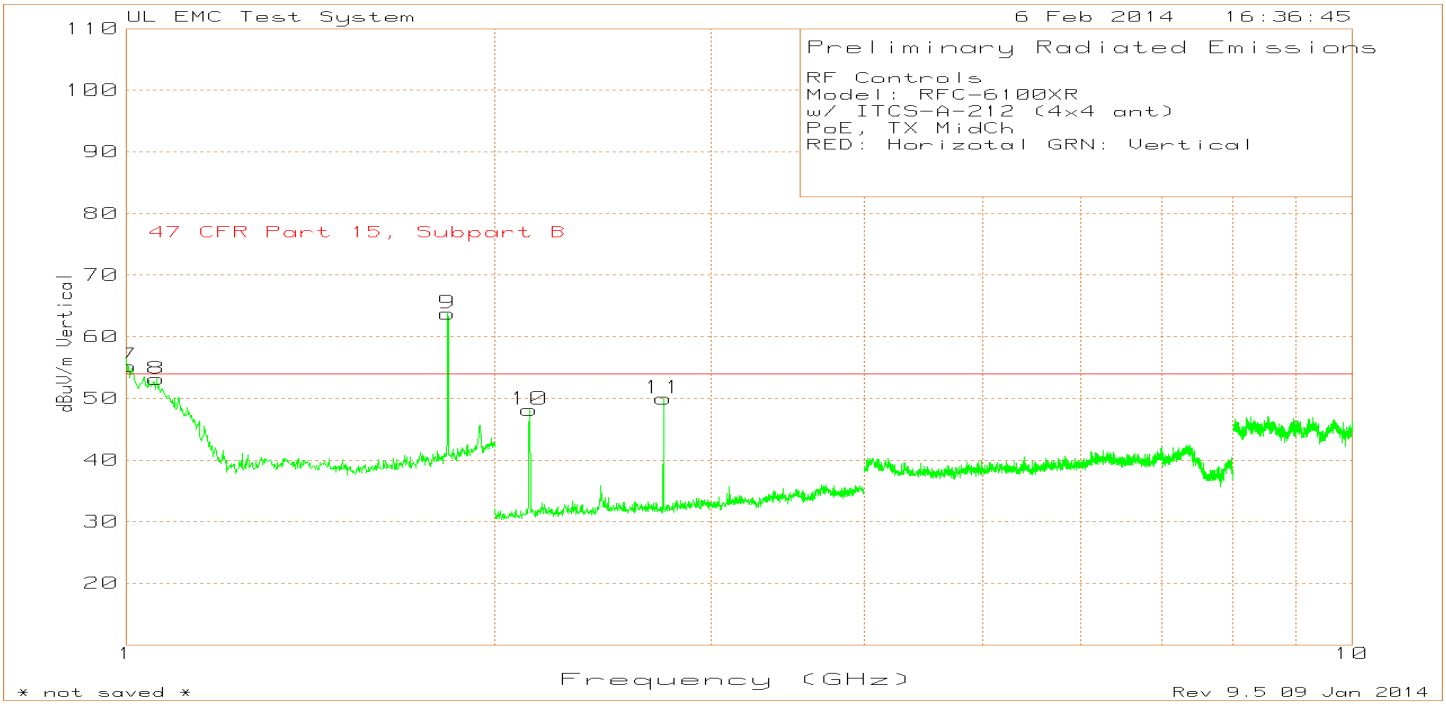
8.3.2. Radiated Emissions 1GHz – 10GHz Middle Channel, Bore Side Beam Setting





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RF Controls
Model: RFC-6100XR
w/ ITCS-A-212 (4x4 ant)
PoE, TX MidCh
RED: Horizotal GRN: Vertical
Trace Markers

Marker No.	Test Frequency GHz	Meter Reading dBuV	Detector	Antenna Factor dB/m	BRF Factor dB	Path Factor dB	Level dBuV/m	Limit FCC 15.209 dBuV/m	Margin (dB)	Azimuth [Degs]	Height [cm]	Polarity
1	* 1.002	80.72	PK	27.4	1.1	-55.85	53.37	54	-0.63	0-360	149	H
2	* 1.0541	81.22	PK	27.3	0.6	-56.01	53.11	54	-0.89	0-360	149	H
3	**1.8297	90.75	PK	30.2	0.4	-53.52	67.83	-	-	0-360	149	H
4	2.1321	68.51	PK	21.5	-	-52.09	37.92	54	-16.08	0-360	149	H
5	* 2.7447	78.8	PK	22.1	-	-50.67	50.23	54	-3.77	0-360	100	H
6	* 9.003	60.33	PK	36.1	-	-48.13	48.3	54	-5.7	0-360	100	H
7	* 1.004	82.57	PK	27.4	1.1	-55.86	55.21	54	1.21	0-360	100	V
8	* 1.0581	81.35	PK	27.2	0.6	-56.01	53.14	54	-0.86	0-360	100	V
9	**1.8297	86.69	PK	30.2	0.4	-53.52	63.77	-	-	0-360	199	V
10	2.1341	78.76	PK	21.5	-	-52.06	48.2	54	-5.8	0-360	149	V
11	* 2.7447	78.6	PK	22.1	-	-50.67	50.03	54	-3.97	0-360	149	V

Radiated Emission Data

	Test Frequency GHz	Meter Reading dBuV	Detector	Antenna Factor dB/m	BRF Factor dB	Path Factor dB	Level dBuV/m	Limit FCC 15.209 dBuV/m	Margin (dB)	Azimuth [Degs]	Height [cm]	Polarity
	* 1.0027	84.79	PK	27.4	1.1	-55.86	57.43	74	-16.57	0	126	H
	* 1.0024	72.61	LnAv	27.4	1.1	-55.85	45.26	54	-8.74	0	126	H
	* 1.0549	83.14	PK	27.3	0.6	-56.01	55.03	74	-18.97	360	116	H
	* 1.0547	72.38	LnAv	27.3	0.6	-56.01	44.27	54	-9.73	360	116	H
	* 1.0033	86.04	PK	27.4	1.1	-55.86	58.68	74	-15.32	360	112	V
	* 1.0039	73.15	LnAv	27.4	1.1	-55.86	45.79	54	-8.21	360	112	V
	* 1.0547	84.34	PK	27.3	0.6	-56.01	56.23	74	-17.77	1	106	V
	* 1.0547	73.3	LnAv	27.3	0.6	-56.01	45.19	54	-8.81	1	106	V
	* 2.744	79.09	PK	22.1	-	-50.67	50.52	74	-23.48	357	105	H
	* 2.7441	76.33	LnAv	22.1	-	-50.67	47.76	54	-6.24	357	105	H
	* 2.744	78.63	PK	22.1	-	-50.67	50.06	74	-23.94	0	150	V
	* 2.7441	75.78	LnAv	22.1	-	-50.67	47.21	54	-6.79	0	150	V

PK - Peak detector
LnAv - Linear Average detector
* Frequencies in restricted bands. General 15.209 limit applies.
** Second Harmonic, Not in Restricted Band, no applicable radiated limits.

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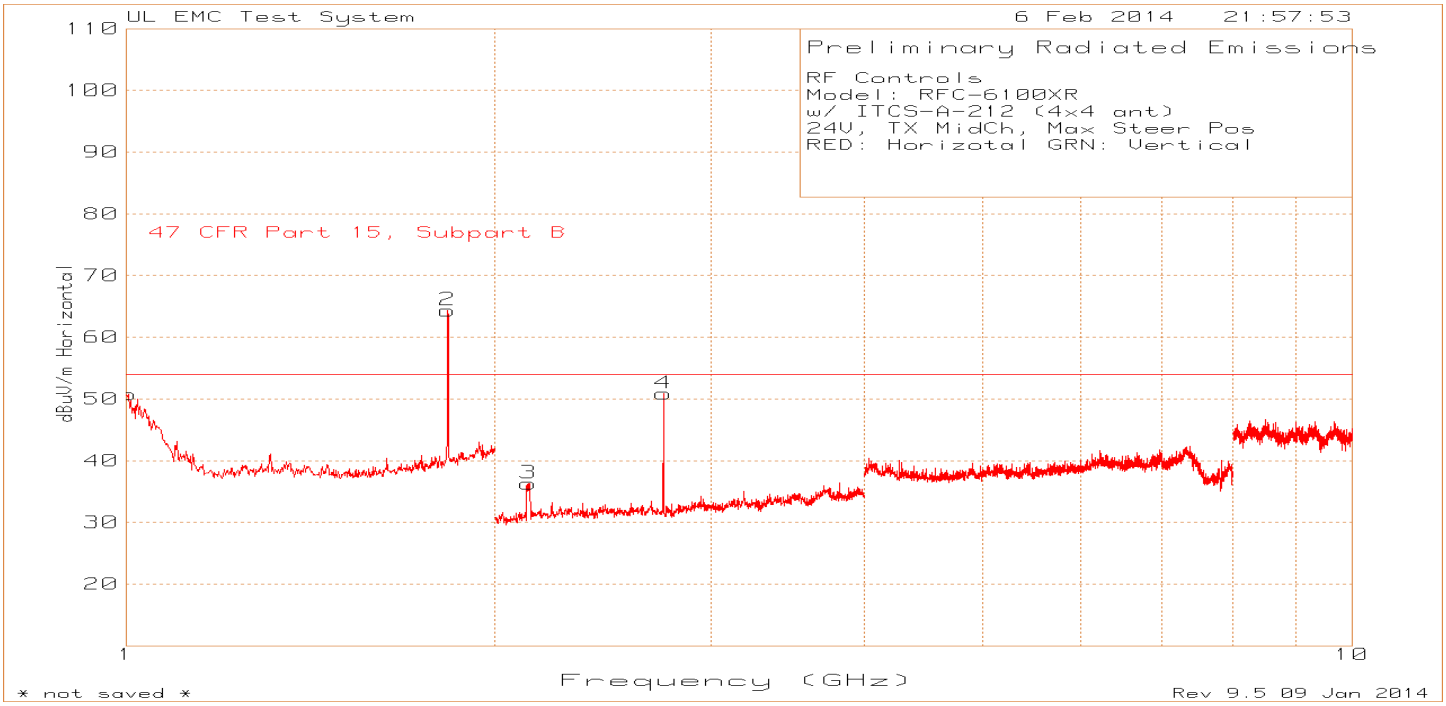
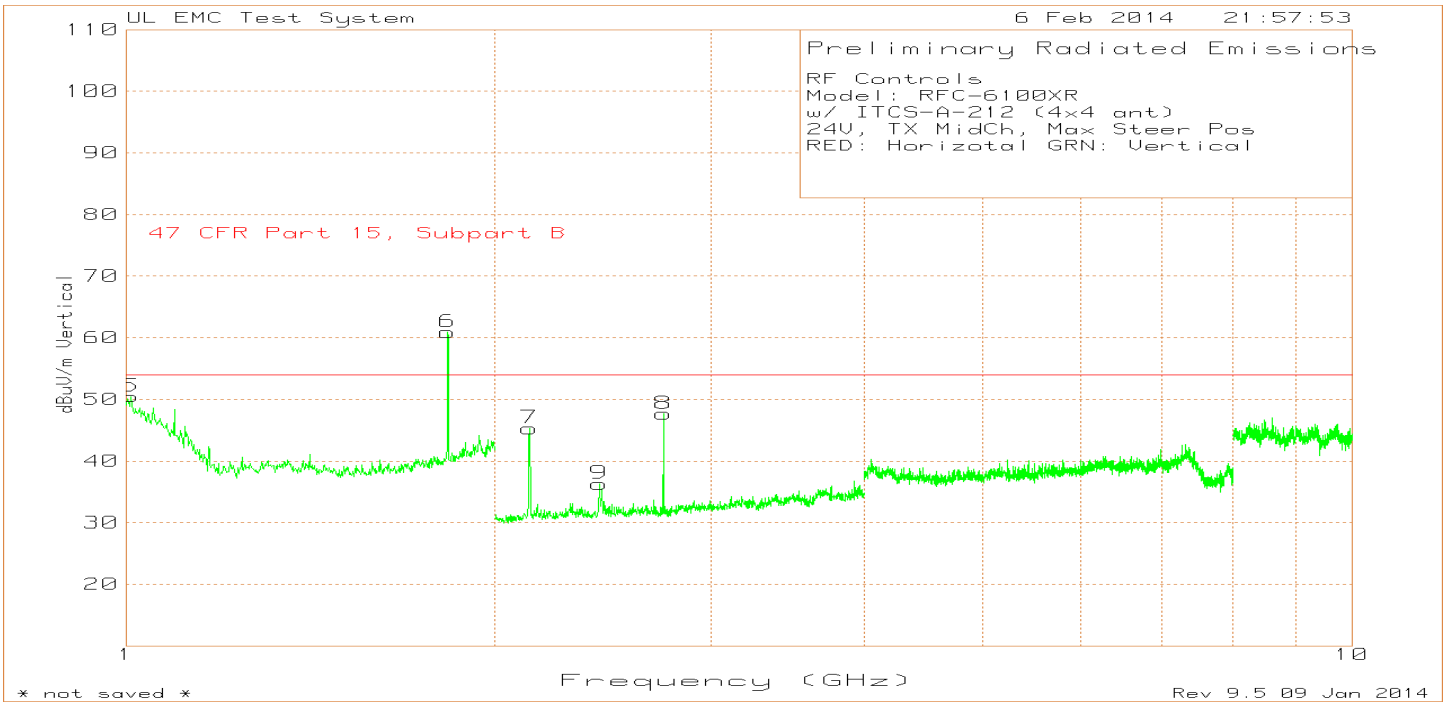
8.3.3. Radiated Emissions 1GHz – 10GHz Middle Channel, Extreme Positive Beam Setting





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RF Controls
Model: RFC-6100XR
w/ ITCS-A-212 (4x4 ant)
24V, TX MidCh, Max Steer Pos
RED: Horizotal GRN: Vertical
Trace Markers

Marker No.	Test Frequency GHz	Meter Reading dBuV	Detector	Antenna Factor dB/m	BRF Factor dB	Path Factor dB	Level dBuV/m	Limit FCC 15.209 dBuV/m	Margin (dB)	Azimuth [Degs]	Height [cm]	Polarity
1	* 1.004	78.17	PK	27.4	1.1	-55.86	50.81	54	-3.19	0-360	149	H
2	**1.8297	87.3	PK	30.2	0.4	-53.52	64.38	-	-	0-360	149	H
3	2.1281	66.99	PK	21.5	-	-52.16	36.33	54	-17.67	0-360	149	H
4	* 2.7447	79.43	PK	22.1	-	-50.67	50.86	54	-3.14	0-360	100	H
5	* 1.008	77.98	PK	27.4	1	-55.88	50.5	54	-3.5	0-360	100	V
6	**1.8297	83.82	PK	30.2	0.4	-53.52	60.9	-	-	0-360	199	V
7	2.1341	75.89	PK	21.5	-	-52.06	45.33	54	-8.67	0-360	149	V
8	* 2.7447	76.23	PK	22.1	-	-50.67	47.66	54	-6.34	0-360	149	V
9	2.4304	65.07	PK	21.9	-	-50.64	36.33	54	-17.67	0-360	100	V

Radiated Emission Data

	Test Frequency GHz	Meter Reading dBuV	Detector	Antenna Factor dB/m	BRF Factor dB	Path Factor dB	Level dBuV/m	Limit FCC 15.209 dBuV/m	Margin (dB)	Azimuth [Degs]	Height [cm]	Polarity
	* 1.0539	79.15	PK	27.3	0.6	-56.01	51.04	74	-22.96	31	136	H
	* 1.0547	68.37	LnAv	27.3	0.6	-56.01	40.26	54	-13.74	31	136	H
	* 1.0026	81.44	PK	27.4	1.1	-55.86	54.08	74	-19.92	31	136	H
	* 1.0026	69.83	LnAv	27.4	1.1	-55.86	42.47	54	-11.53	31	136	H
	* 1.0077	80.39	PK	27.4	1	-55.88	52.91	74	-21.09	36	108	V
	* 1.0071	68.56	LnAv	27.4	1	-55.88	41.08	54	-12.92	36	108	V
	* 2.7441	80.45	PK	22.1	-	-50.67	51.88	74	-22.12	315	100	H
	* 2.7441	77.82	LnAv	22.1	-	-50.67	49.25	54	-4.75	315	100	H
	* 2.7441	77.79	PK	22.1	-	-50.67	49.22	74	-24.78	5	144	V
	* 2.7441	74.95	LnAv	22.1	-	-50.67	46.38	54	-7.62	5	144	V

PK - Peak detector
LnAv - Linear Average detector
** Second Harmonic, Not in Restricted Band, no applicable radiated limits.

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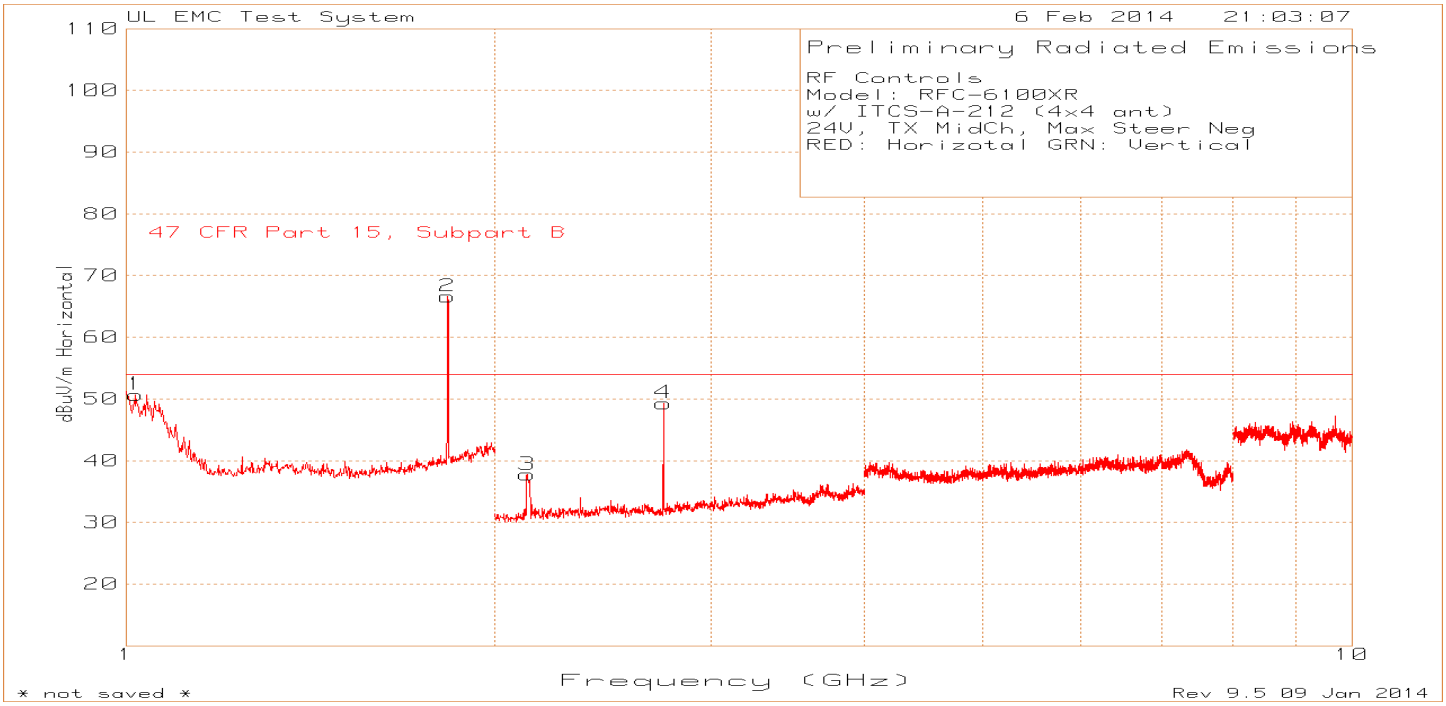
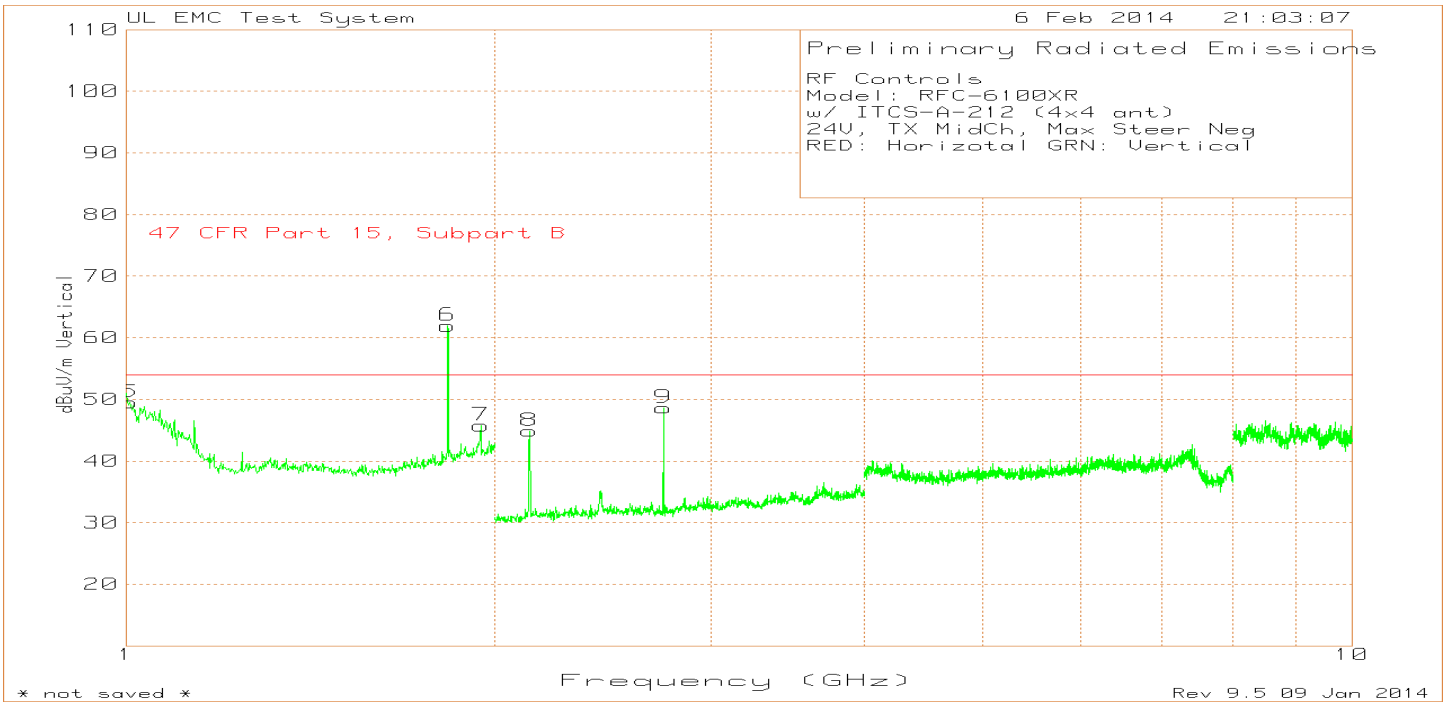
8.3.4. Radiated Emissions 1GHz – 10GHz Middle Channel, Extreme Negative Beam Setting





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RF Controls
Model: RFC-6100XR
w/ ITCS-A-212 (4x4 ant)
24V, TX MidCh, Max Steer Neg
RED: Horizotal GRN: Vertical
Trace Markers

Marker No.	Test Frequency GHz	Meter Reading dBuV	Detector	Antenna Factor dB/m	BRF Factor dB	Path Factor dB	Level dBuV/m	Limit FCC 15.209 dBuV/m	Margin (dB)	Azimuth [Degs]	Height [cm]	Polarity
1	* 1.018	78.53	PK	27.4	0.8	-56.03	50.7	54	-3.3	0-360	149	H
2	**1.8297	89.52	PK	30.2	0.4	-53.52	66.6	-	-	0-360	149	H
3	2.1241	68.43	PK	21.5	-	-52.19	37.74	54	-16.26	0-360	149	H
4	* 2.7447	77.86	PK	22.1	-	-50.67	49.29	54	-4.71	0-360	100	H
5	* 1.006	76.97	PK	27.4	1	-55.87	49.5	54	-4.5	0-360	100	V
6	**1.8297	84.9	PK	30.2	0.4	-53.52	61.98	-	-	0-360	199	V
7	1.9459	66.86	PK	31.4	0.5	-52.97	45.79	54	-8.21	0-360	149	V
8	2.1341	75.47	PK	21.5	-	-52.06	44.91	54	-9.09	0-360	100	V
9	* 2.7447	77.24	PK	22.1	-	-50.67	48.67	54	-5.33	0-360	149	V

Radiated Emission Data

	Test Frequency GHz	Meter Reading dBuV	Detector	Antenna Factor dB/m	BRF Factor dB	Path Factor dB	Level dBuV/m	Limit FCC 15.209 dBuV/m	Margin (dB)	Azimuth [Degs]	Height [cm]	Polarity
	* 1.047	81.72	PK	27.3	0.6	-56.08	53.54	74	-20.46	328	120	H
	* 1.0459	68.84	LnAv	27.3	0.6	-56.09	40.65	54	-13.35	328	120	H
	* 1.006	79.79	PK	27.4	1	-55.87	52.32	74	-21.68	332	107	V
	* 1.0051	67.87	LnAv	27.4	1	-55.87	40.4	54	-13.6	332	107	V
	* 2.7441	77.85	PK	22.1	-	-50.67	49.28	74	-24.72	288	100	H
	* 2.7441	74.91	LnAv	22.1	-	-50.67	46.34	54	-7.66	288	100	H
	* 2.7441	78.13	PK	22.1	-	-50.67	49.56	74	-24.44	18	145	V
	* 2.7441	75.15	LnAv	22.1	-	-50.67	46.58	54	-7.42	18	145	V

PK - Peak detector
LnAv - Linear Average detector
** Second Harmonic, Not in Restricted Band, no applicable radiated limits.

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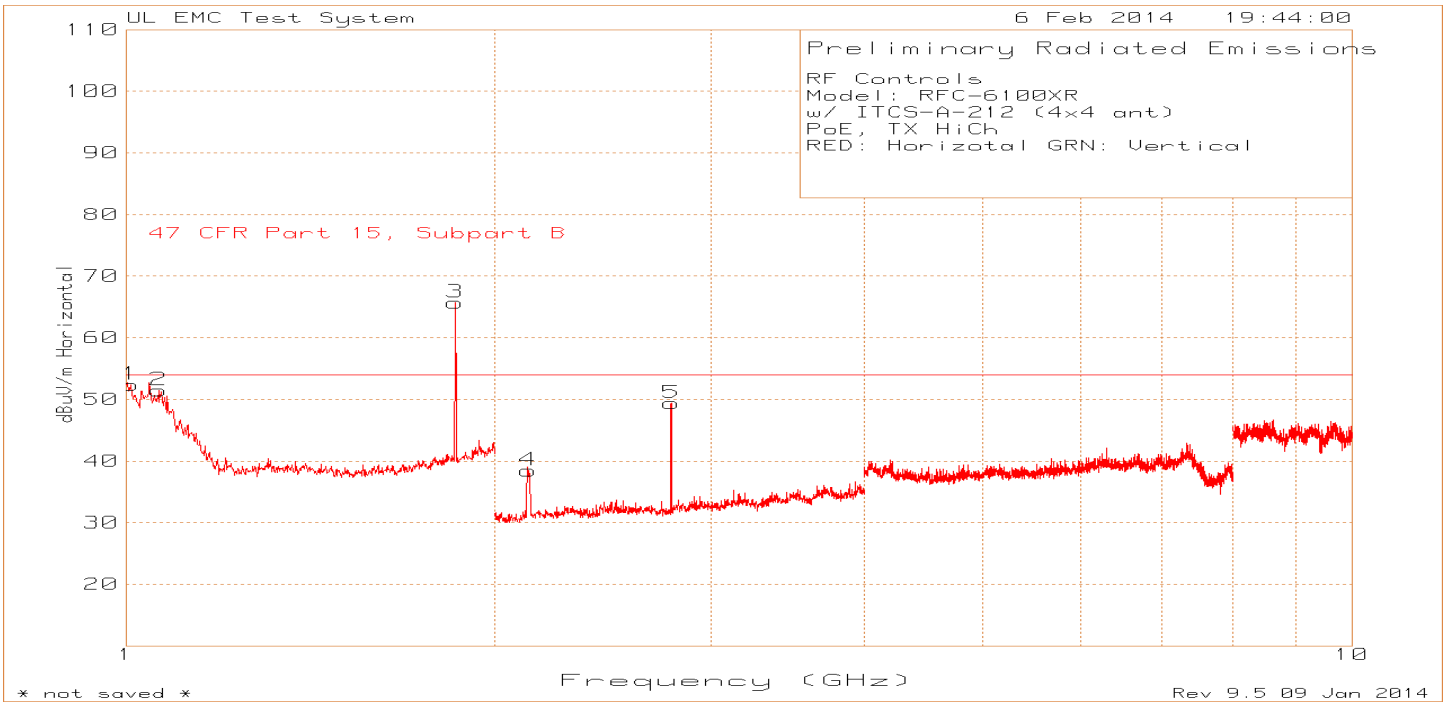
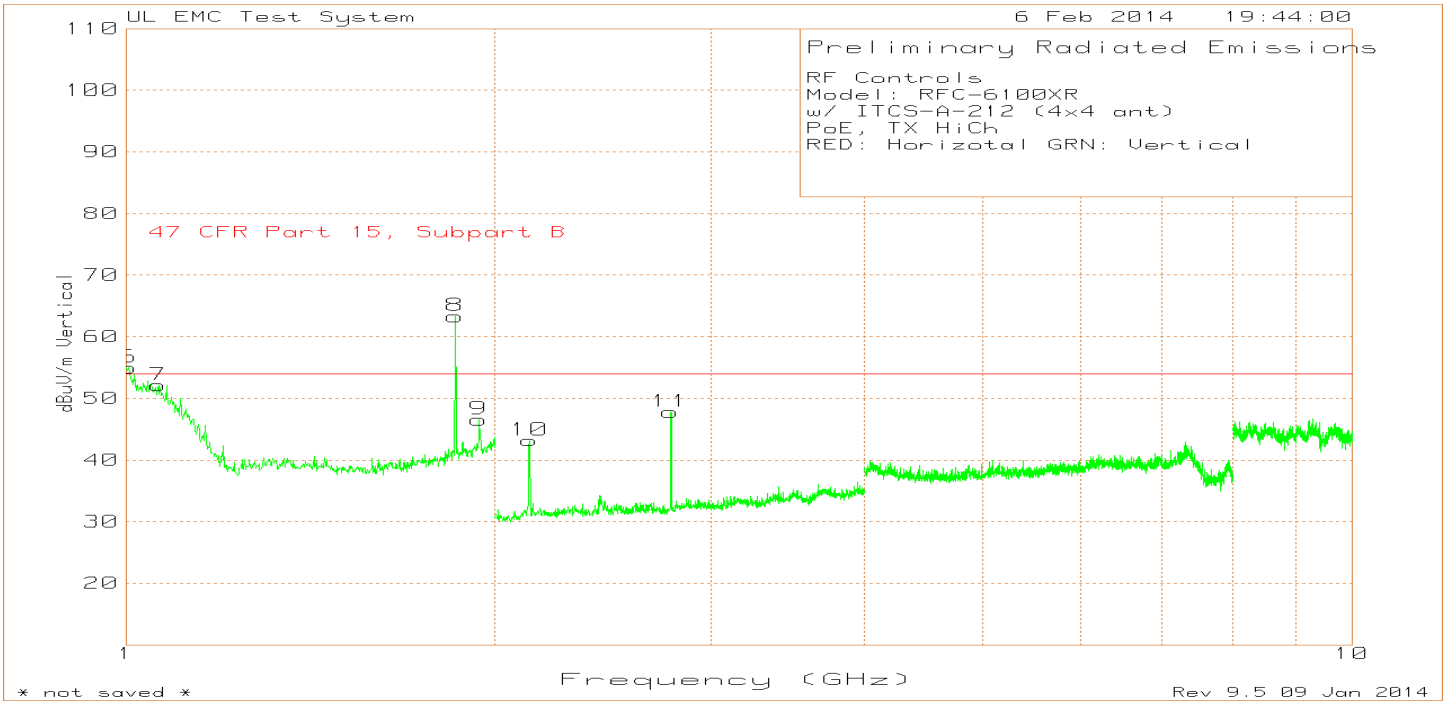
8.3.5. Radiated Emissions 1GHz – 10GHz High Channel, Bore Side Beam Setting





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RF Controls
Model: RFC-6100XR
w/ ITCS-A-212 (4x4 ant)
PoE, TX HiCh
RED: Horizotal GRN: Vertical
Trace Markers

Marker No.	Test Frequency GHz	Meter Reading dBuV	Detector	Antenna Factor dB/m	BRF Factor dB	Path Factor dB	Level dBuV/m	Limit FCC 15.209 dBuV/m	Margin (dB)	Azimuth [Degs]	Height [cm]	Polarity
1	* 1.008	79.84	PK	27.4	1	-55.88	52.36	54	-1.64	0-360	149	H
2	* 1.0641	79.78	PK	27.2	0.5	-56	51.48	54	-2.52	0-360	149	H
3	**1.8557	88.13	PK	30.6	0.4	-53.4	65.73	-	-	0-360	149	H
4	2.1301	69.1	PK	21.5	-	-52.13	38.47	54	-15.53	0-360	149	H
5	* 2.7828	77.64	PK	22.2	-	-50.46	49.38	54	-4.62	0-360	100	H
6	* 1.004	82.39	PK	27.4	1.1	-55.86	55.03	54	1.03	0-360	100	V
7	* 1.0621	80.43	PK	27.2	0.5	-56.01	52.12	54	-1.88	0-360	100	V
8	**1.8557	85.76	PK	30.6	0.4	-53.4	63.36	-	-	0-360	149	V
9	1.9399	67.62	PK	31.4	0.5	-52.97	46.55	54	-7.45	0-360	100	V
10	2.1341	73.76	PK	21.5	-	-52.06	43.2	54	-10.8	0-360	100	V
11	* 2.7808	76.06	PK	22.2	-	-50.48	47.78	54	-6.22	0-360	149	V

Radiated Emission Data

	Test Frequency GHz	Meter Reading dBuV	Detector	Antenna Factor dB/m	BRF Factor dB	Path Factor dB	Level dBuV/m	Limit FCC 15.209 dBuV/m	Margin (dB)	Azimuth [Degs]	Height [cm]	Polarity
	* 1.0074	84.19	PK	27.4	1	-55.88	56.71	74	-17.29	0	126	H
	* 1.0072	72.13	LnAv	27.4	1	-55.88	44.65	54	-9.35	0	126	H
	* 1.0665	83.93	PK	27.2	0.5	-55.97	55.66	74	-18.34	360	131	H
	* 1.0672	71.4	LnAv	27.2	0.5	-55.96	43.14	54	-10.86	360	131	H
	* 1.0036	85.82	PK	27.4	1.1	-55.86	58.46	74	-15.54	0	111	V
	* 1.0031	72.92	LnAv	27.4	1.1	-55.86	45.56	54	-8.44	0	111	V
	* 1.0673	83.74	PK	27.2	0.5	-55.96	55.48	74	-18.52	360	105	V
	* 1.0672	72.62	LnAv	27.2	0.5	-55.96	44.36	54	-9.64	360	105	V
	* 2.7815	79.54	PK	22.2	-	-50.47	51.27	74	-22.73	48	111	H
	* 2.7816	77.16	LnAv	22.2	-	-50.47	48.89	54	-5.11	48	111	H
	* 2.7816	77.32	PK	22.2	-	-50.47	49.05	74	-24.95	356	147	V
	* 2.7816	74.54	LnAv	22.2	-	-50.47	46.27	54	-7.73	356	147	V

PK - Peak detector
LnAv - Linear Average detector
** Second Harmonic, Not in Restricted Band, no applicable radiated limits.

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9. AC POWER LINE CONDUCTED EMISSIONS

LIMITS

FCC §15.207 (a)

RSS-Gen 7.2.2

Frequency of Emission (MHz)	Conducted Limit (dBuV)	
	Quasi-peak	Average
0.15-0.5	66 to 56 *	56 to 46 *
0.5-5	56	46
5-30	60	50

* Decreases with the logarithm of the frequency.

TEST PROCEDURE

The EUT is placed on a non-conducting table 40 cm from the vertical ground plane and 80 cm above the horizontal ground plane. The EUT is configured in accordance with ANSI C63.4.

The receiver is set to a resolution bandwidth of 9 kHz. Peak detection is used unless otherwise noted as quasi-peak or average.

Line conducted data is recorded for both NEUTRAL and HOT lines.

RESULTS

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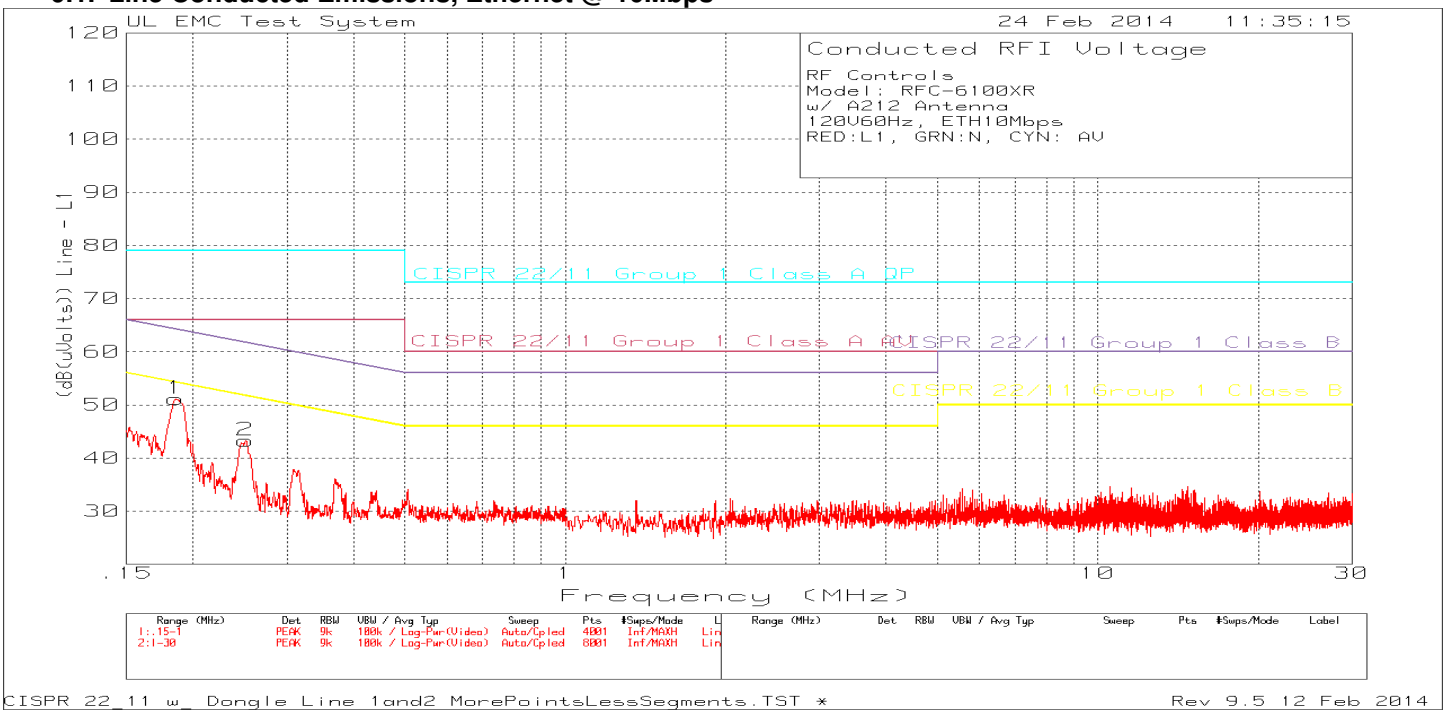
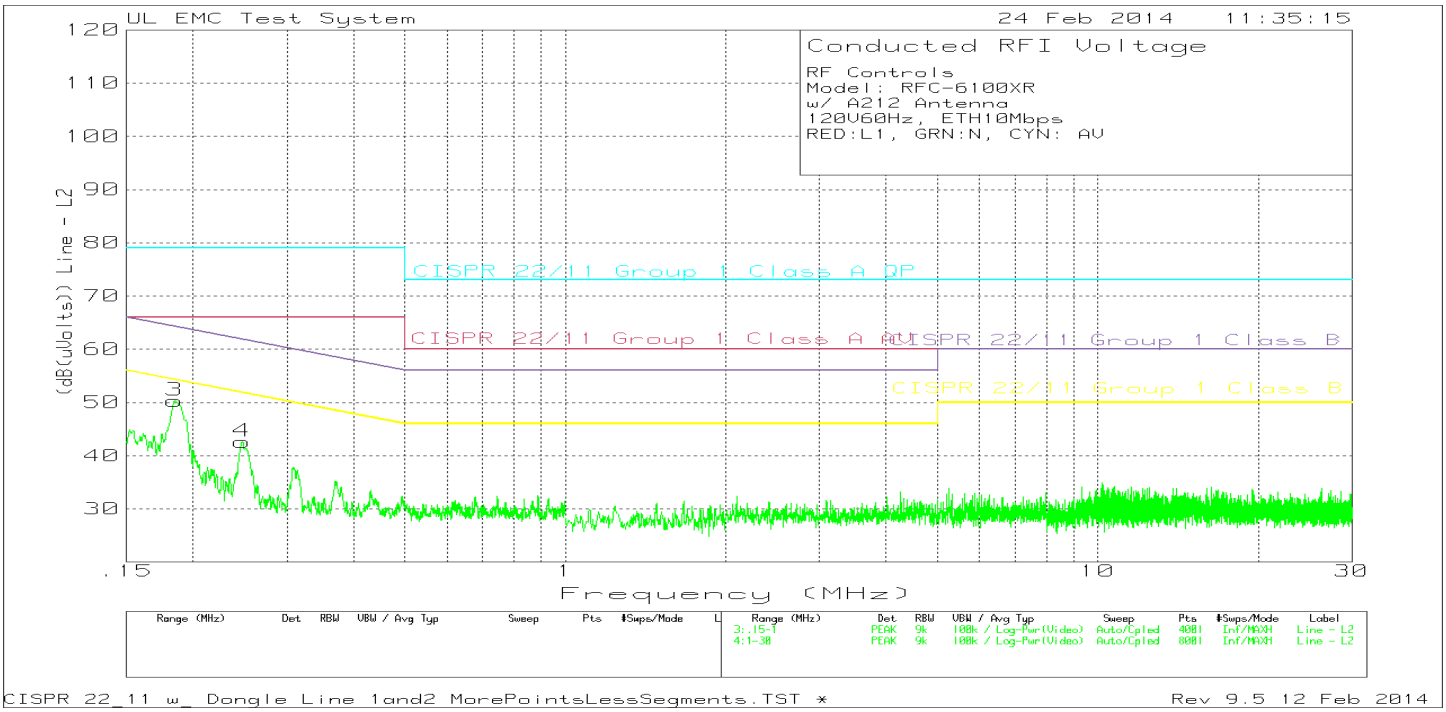
9.1. Line Conducted Emissions, Ethernet @ 10Mbps





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RF Controls
Model: RFC-6100XR
w/ A212 Antenna
120V60Hz, ETH10Mbps
RED:L1, GRN:N, CYN: AV

Trace Markers

Test No.	Frequency (MHz)	Meter Reading	Transducer Factor (dB)	Gain/Loss Factor (dB)	Corrected Reading (dB(uVolts))	Limit:1	2	3	4	5	6
Line - L1											
1	.18549	39.3dBuV PK	.1	11.7	51.1	79	66	64.24	54.24	-	-
					Margin (dB)	-27.9	-14.9	-13.14	-3.14	-	-
2	.25126	31.96dBuV PK	.1	11.2	43.26	79	66	61.72	51.72	-	-
					Margin (dB)	-35.74	-22.74	-18.46	-8.46	-	-
Line - L2											
3	.18506	38.44dBuV PK	.1	11.8	50.34	79	66	64.26	54.26	-	-
					Margin (dB)	-28.66	-15.66	-13.92	-3.92	-	-
4	.24743	31.21dBuV PK	.1	11.3	42.61	79	66	61.84	51.84	-	-
					Margin (dB)	-36.39	-23.39	-19.23	-9.23	-	-

LIMIT 1: CISPR 22/11 Group 1 Class A QP
LIMIT 2: CISPR 22/11 Group 1 Class A AV
LIMIT 3: CISPR 22/11 Group 1 Class B QP
LIMIT 4: CISPR 22/11 Group 1 Class B AV

PK - Peak detector

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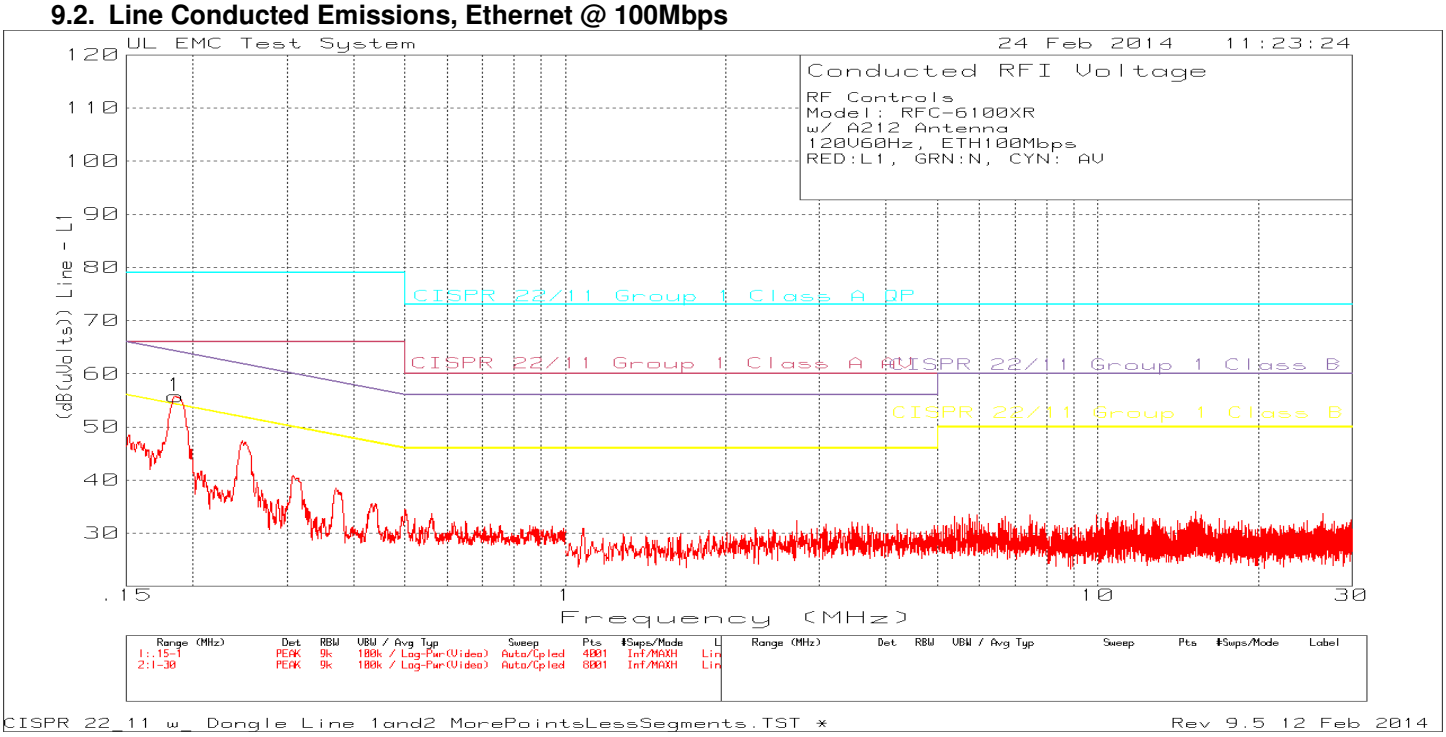
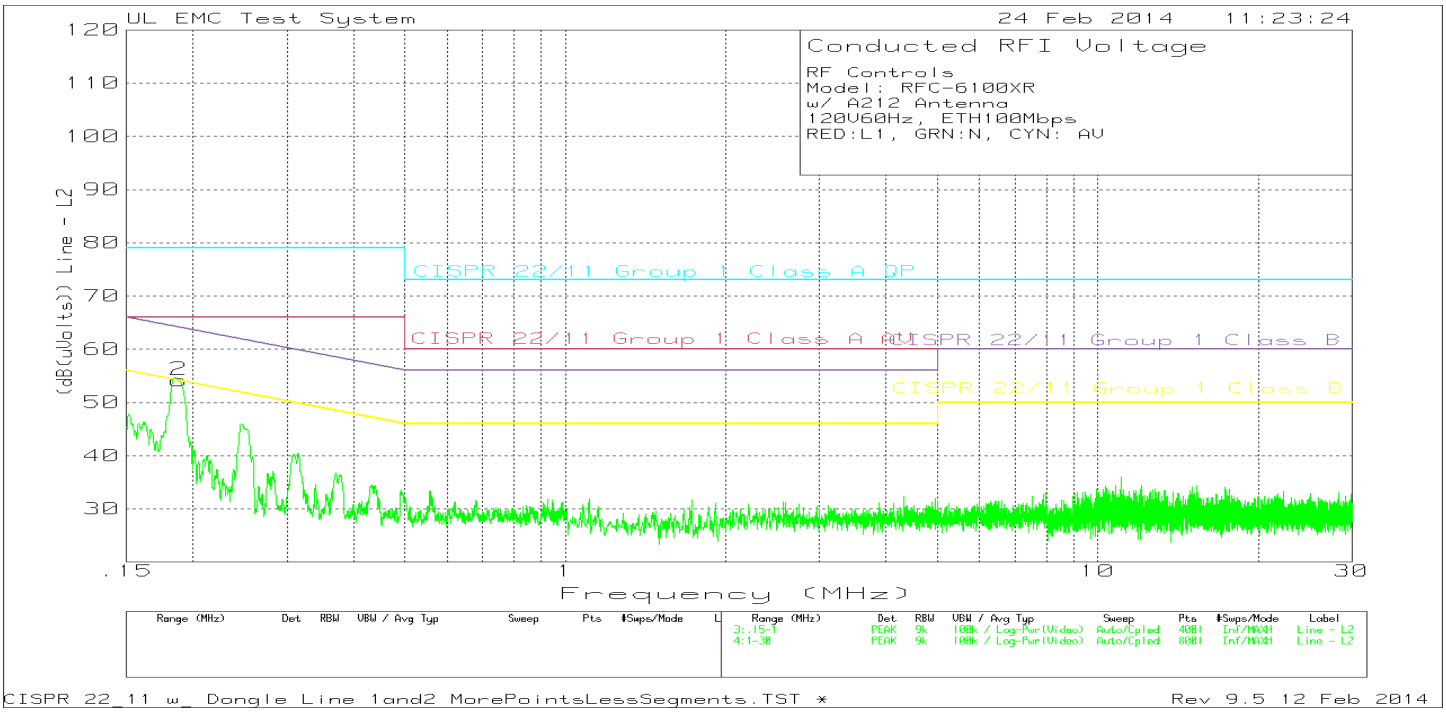
9.2. Line Conducted Emissions, Ethernet @ 100Mbps





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RF Controls
Model: RFC-6100XR
w/ A212 Antenna
120V60Hz, ETH100Mbps
RED:L1, GRN:N, CYN: AV

Trace Markers

No.	Test Frequency (MHz)	Meter Reading	Transducer Factor (dB)	Gain/Loss Factor (dB)	Corrected Reading (dB(uVolts))	Limit:1	2	3	4	5	6
Line - L1											
1	.18528	44.02dBuV PK	.1	11.7	55.82	79	66	64.25	54.25	-	-
					Margin (dB)	-23.18	-10.18	-8.43	1.57	-	-
Line - L2											
2	.18825	42.51dBuV PK	.1	11.6	54.21	79	66	64.11	54.11	-	-
					Margin (dB)	-24.79	-11.79	-9.9	.1	-	-

Quais-peak Data

Test Frequency (MHz)	Meter Reading	Transducer Factor (dB)	Gain/Loss Factor (dB)	Corrected Reading(dB(uVolts))	Limit:1	2	3	4	5
Line - L1 .15 - 1MHz									
.18534	41.07dBuV QP	.1	11.7	52.87	79	66	64.24	54.24	-	-
			Margin (dB):		-26.13	-13.13	-11.37	-1.37	-	-
Line - L2 .15 - 1MHz										
.18533	40.72dBuV QP	.1	11.8	52.62	79	66	64.24	54.24	-	-
			Margin (dB):		-26.38	-13.38	-11.62	-1.62	-	-

Average Data

Test Frequency (MHz)	Meter Reading	Transducer Factor (dB)	Gain/Loss Factor (dB)	Corrected Reading(dB(uVolts))	Limit:1	2	3	4	5
Line - L1 .15 - 1MHz									
.18534	27.11dBuV Av	.1	11.7	38.91	79	66	64.24	54.24	-	-
			Margin (dB):		-40.09	-27.09	-25.33	-15.33	-	-
Line - L2 .15 - 1MHz										
.18533	26.48dBuV Av	.1	11.8	38.38	79	66	64.24	54.24	-	-
			Margin (dB):		-40.62	-27.62	-25.86	-15.86	-	-

NOTE: "+" - Indicates an emission level in excess of the applicable limit (s).

PK - Peak detector
QP - Quasi-Peak detector
Av - average detection

LIMIT 1: CISPR 22/11 Group 1 Class A QP
LIMIT 2: CISPR 22/11 Group 1 Class A AV
LIMIT 3: CISPR 22/11 Group 1 Class B QP
LIMIT 4: CISPR 22/11 Group 1 Class B AV

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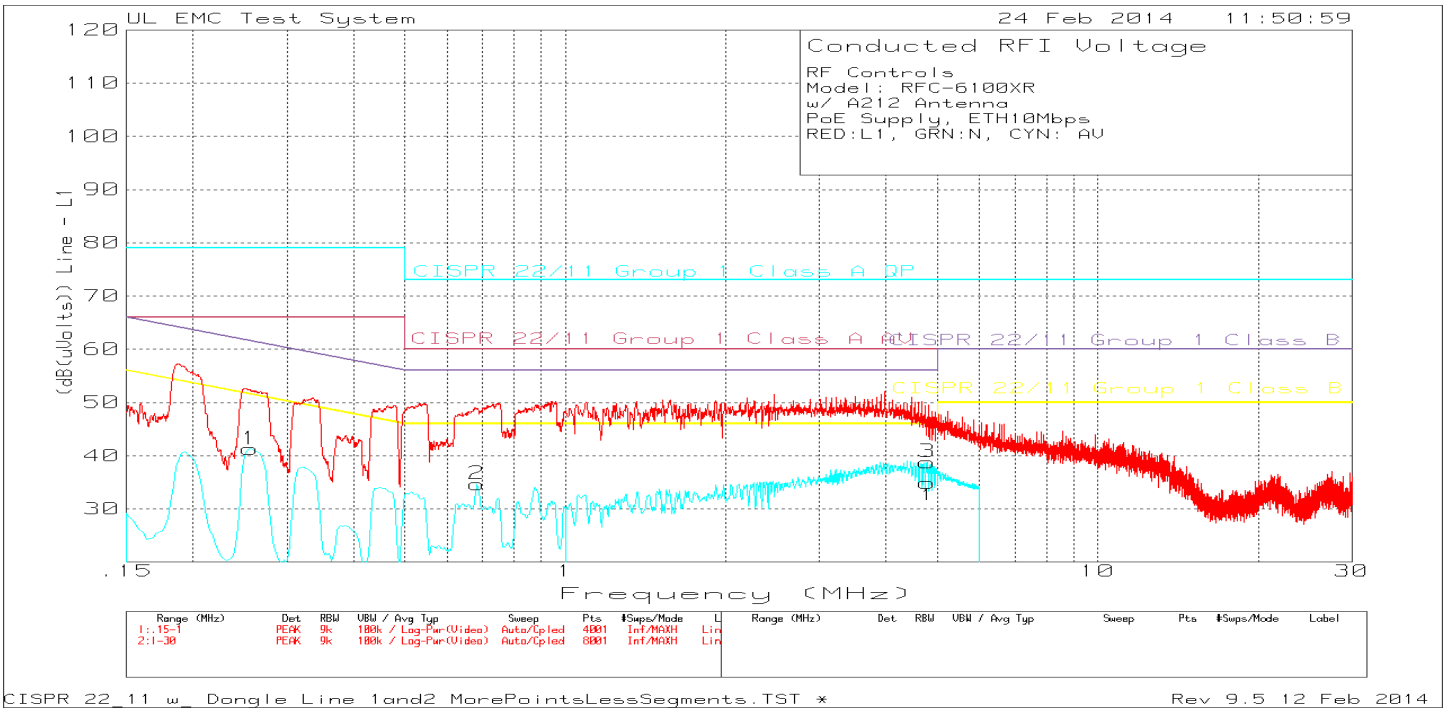
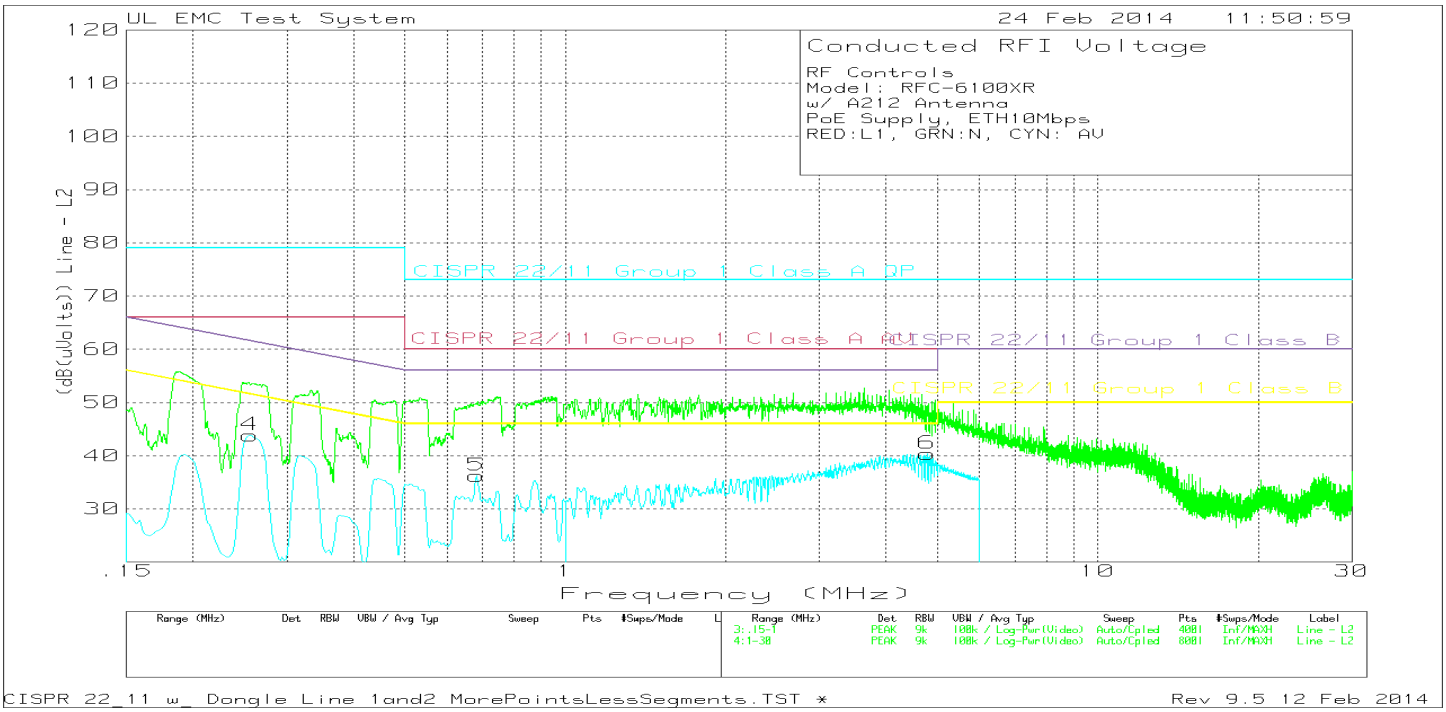
9.3. Line Conducted Emissions PoE Adapter, Ethernet @ 10Mbps





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RF Controls
Model: RFC-6100XR
w/ A212 Antenna
PoE Supply, ETH10Mbps
RED:L1, GRN:N, CYN: AV

Trace Markers

No.	Test Frequency (MHz)	Meter Reading	Transducer Factor (dB)	Gain/Loss Factor (dB)	Corrected Reading (dB(uVolts))	Limit:1	2	3	4	5	6
Line - L1											
1	.25575	29.94dBuV Av	.1	11.2	41.24	79	66	61.57	51.57	-	-
					Margin (dB)	-37.76	-24.76	-20.33	-10.33	-	-
2	.68325	23.98dBuV Av	.1	10.6	34.68	73	60	56	46	-	-
					Margin (dB)	-38.32	-25.32	-21.32	-11.32	-	-
3	4.789	28.02dBuV Av	.1	10.7	38.82	73	60	56	46	-	-
					Margin (dB)	-34.18	-21.18	-17.18	-7.18	-	-
Line - L2											
4	.25575	32.5dBuV Av	.1	11.2	43.8	79	66	61.57	51.57	-	-
					Margin (dB)	-35.2	-22.2	-17.77	-7.77	-	-
5	.681	25.51dBuV Av	.1	10.6	36.21	73	60	56	46	-	-
					Margin (dB)	-36.79	-23.79	-19.79	-9.79	-	-
6	4.78	29.44dBuV Av	.1	10.8	40.34	73	60	56	46	-	-
					Margin (dB)	-32.66	-19.66	-15.66	-5.66	-	-

PK - Peak detector
QP - Quasi-Peak detector
Av - Average detector

LIMIT 1: CISPR 22/11 Group 1 Class A QP
LIMIT 2: CISPR 22/11 Group 1 Class A AV
LIMIT 3: CISPR 22/11 Group 1 Class B QP
LIMIT 4: CISPR 22/11 Group 1 Class B AV

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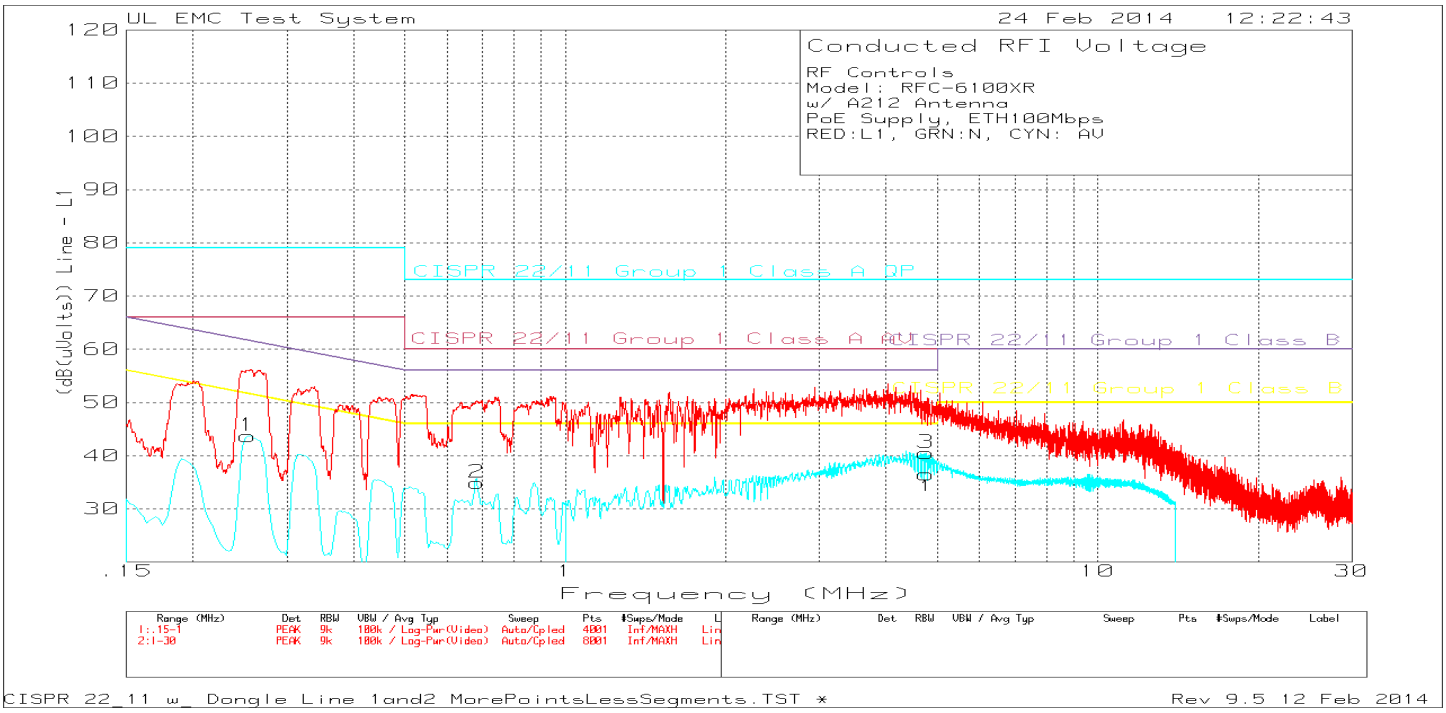
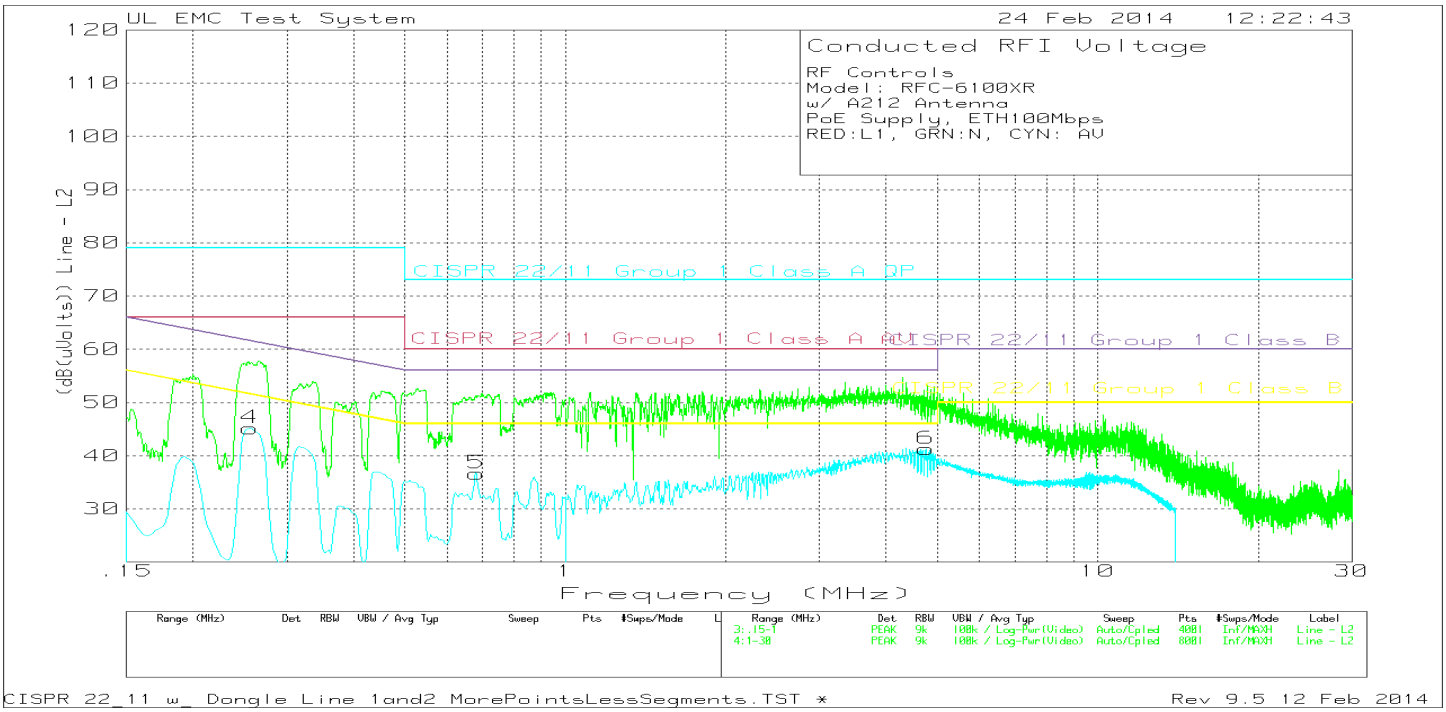
9.4. Line Conducted Emissions PoE Adapter, Ethernet @ 100Mbps





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RF Controls
Model: RFC-6100XR
w/ A212 Antenna
PoE Supply, ETH100Mbps
RED:L1, GRN:N, CYN: AV

Trace Markers

No.	Test Frequency (MHz)	Meter Reading	Transducer Factor (dB)	Gain/Loss Factor (dB)	Corrected Reading (dB(uVolts))	Limit:1	2	3	4	5	6
Line - L1											
1	.2535	32.36dBuV Av	.1	11.2	43.66	79	66	61.64	51.64	-	-
					Margin (dB)	-35.34	-22.34	-17.98	-7.98	-	-
2	.68325	24.26dBuV Av	.1	10.6	34.96	73	60	56	46	-	-
					Margin (dB)	-38.04	-25.04	-21.04	-11.04	-	-
3	4.771	29.68dBuV Av	.1	10.7	40.48	73	60	56	46	-	-
					Margin (dB)	-32.52	-19.52	-15.52	-5.52	-	-
Line - L2											
4	.25575	33.84dBuV Av	.1	11.2	45.14	79	66	61.57	51.57	-	-
					Margin (dB)	-33.86	-20.86	-16.43	-6.43	-	-
5	.681	25.93dBuV Av	.1	10.6	36.63	73	60	56	46	-	-
					Margin (dB)	-36.37	-23.37	-19.37	-9.37	-	-
6	4.7665	30.36dBuV Av	.1	10.8	41.26	73	60	56	46	-	-
					Margin (dB)	-31.74	-18.74	-14.74	-4.74	-	-

PK - Peak detector
QP - Quasi-Peak detector
Av - average detection

LIMIT 1: CISPR 22/11 Group 1 Class A QP
LIMIT 2: CISPR 22/11 Group 1 Class A AV
LIMIT 3: CISPR 22/11 Group 1 Class B QP
LIMIT 4: CISPR 22/11 Group 1 Class B AV

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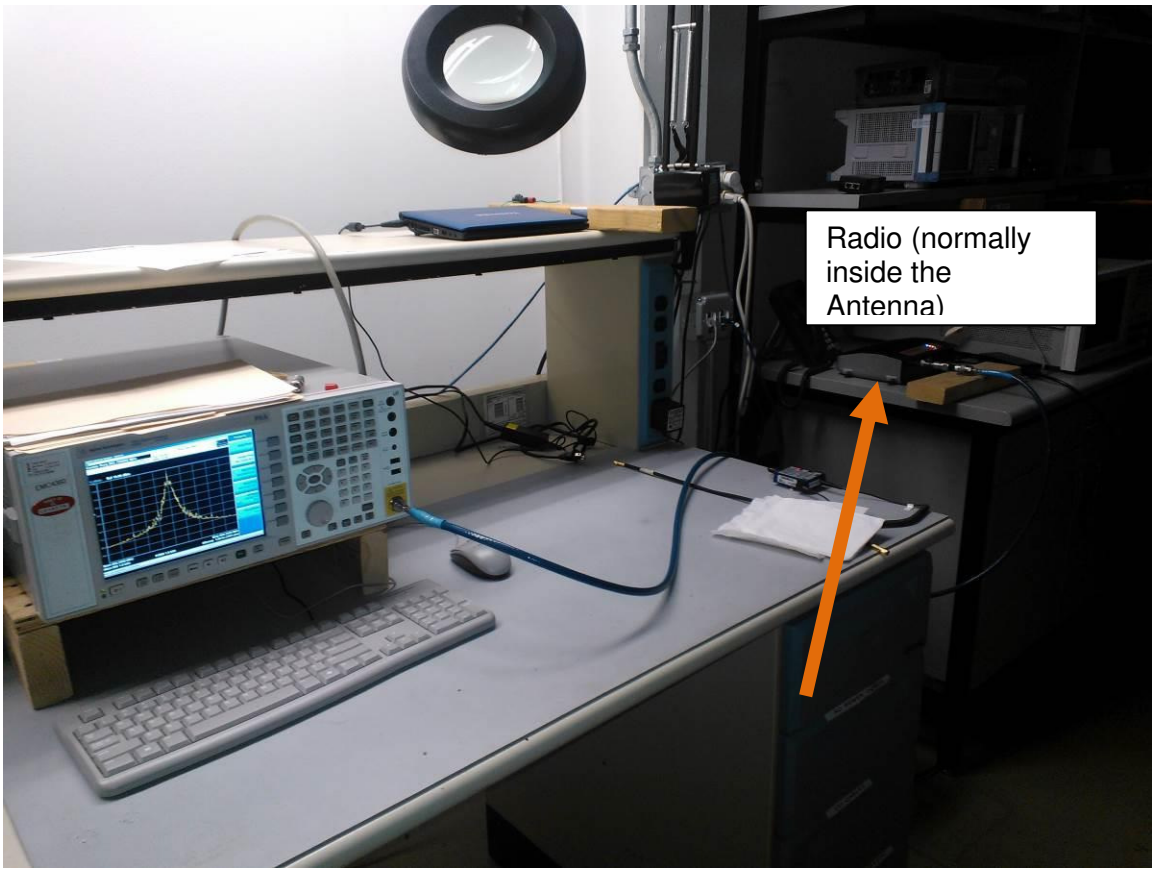
10. SETUP PHOTOS

ANTENNA PORT CONDUCTED RF MEASUREMENT SETUP



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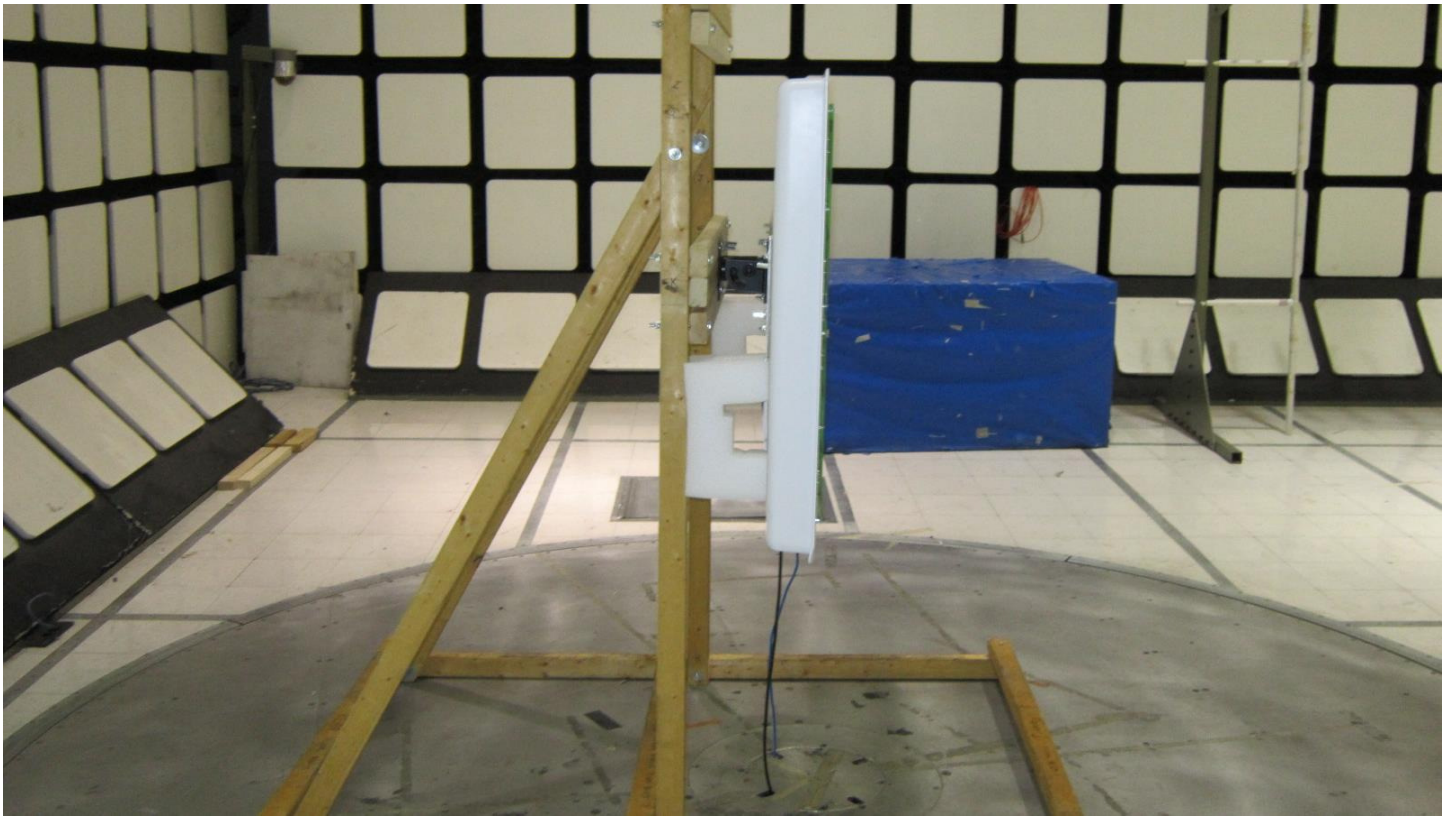
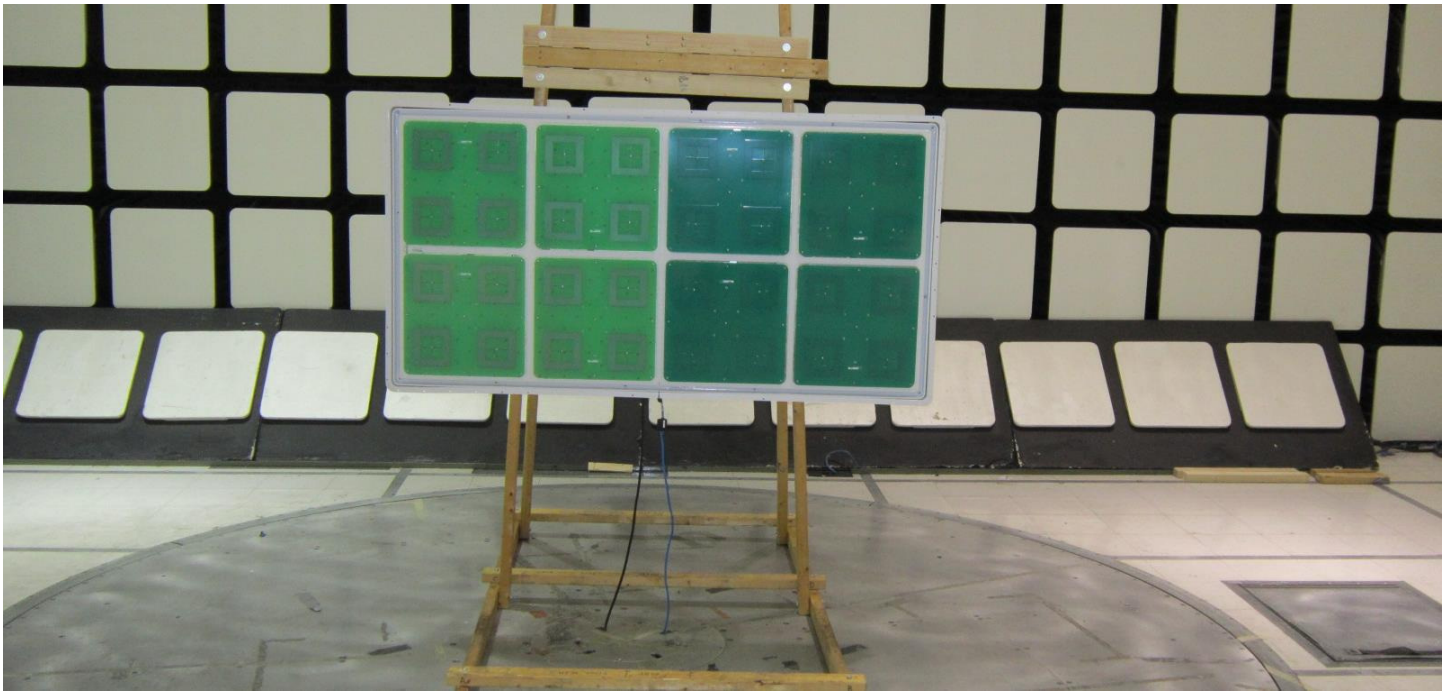
RADIATED RF MEASUREMENT SETUP (BELOW 1 GHz)





* Representative photos only. Actual EUT is ½ the size of the EUT shown (4x4) pattern configuration.

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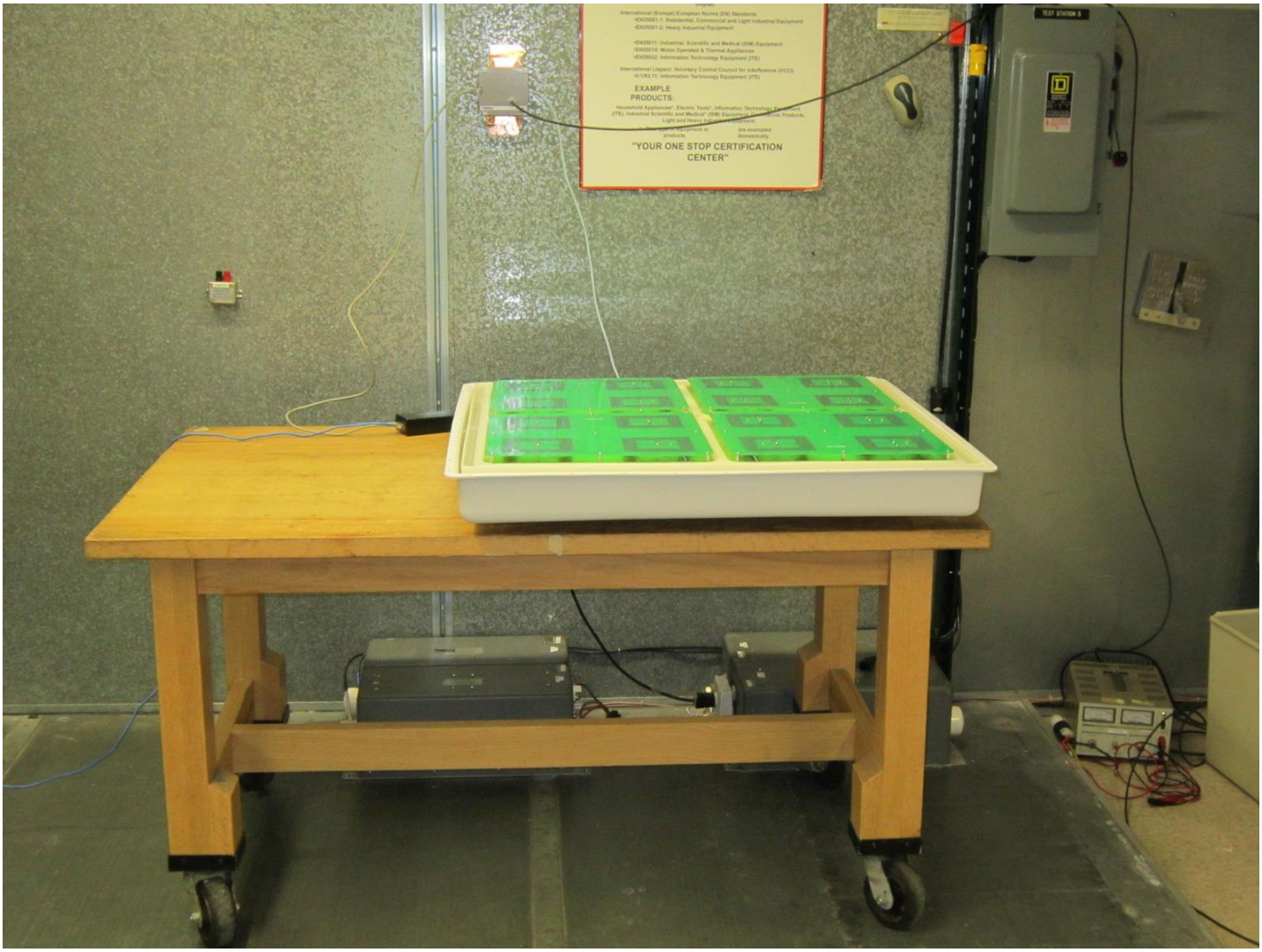
POWERLINE CONDUCTED EMISSIONS MEASUREMENT SETUP



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